A FACTORIAL PARAMETER ANALYSIS OF SCHAFFER'S AMBUSH COMBAT MODEL

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THESIS

A FACTORIAL PARAMETER ANALYSIS OF SCHAFFER'S AMBUSH COMBAT MODEL

by

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A Factorial Parameter Analysis of Schaffer's
Ambush Combat Model

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LIST OF SYMBOLS

A_y = area over which targets are dispersed

A_T = presented area of personnel targets

a,b = constants associated with troop discipline

$E_{i,j}$ = supporting-weapon efficiencies (i types on side x, j type of side y)

H = unit step function

k = direct-fire weapon efficiencies

k',k"= constants associated with the shift from area fire to aimed fire

x = numerical strength of infantrymen on side X (usually defender or ambushee)

y = numerical strength of infantrymen on side Y, (usually aggressor or ambusher)

$P_{h,k}$ = single-hit disablement probability

r = average rate of fire

t = time of engagement

$W_{i,j}$ = supporting weapon strengths (type i or j)

α,β = constants associated with the time dependency of a cover function

γ = constant associated with the speed of shifting from area fire to aimed fire

σ = single shot radial dispersion of fire

$c_x(t)$ = desertion coefficient of the ambushee force

$c_y(t)$ = desertion coefficient of the ambusher force

I. INTRODUCTION

The ambush has become a very popular form of combat during the past twenty years. Using fewer men with the help of some explosive mines and a sudden surprise attack from a concealed and well-protected position, the ambusher force usually achieves a significant advantage over the force being ambushed. Ambush actions in the past and the guerrilla warfare in Southeast Asia suggest that an effective ambusher force size is about one third or one fourth that of the ambushee force [3]. Typical ambush tactics involve waiting in the area where the enemy is expected to pass by; when the enemy has completely entered a pre-selected "killing zone" the ambushers begin the surprise attack with a very high rate of fire. Then, the rate of fire is slightly reduced and the ambushers begin to withdraw. In most ambush attacks, the ambushers use explosives such as claymores, hand grenades, or other devices to cut down the enemy force size and firepower at the beginning of ambush engagement.

Often the ambush engagement lasts only a short period of time, for example, two to five minutes, because the ambushers prefer a "hit and run" tactic to a prolonged engagement. Having taken advantage of the surprise factor, it is preferable to withdraw if the ambusher force is outnumbered, or fears the arrival of a reaction force or reaction supporting fire.

The ambush has been modeled by Marvin B. Schaffer [6] who developed from Lanchester's basic models attrition rate equations permitting numerical computation of the ambusher force level and the ambushee force level at specific times. Schaffer's ambush combat model includes many parameters describing the nature of the conflict and the capabilities and behavior of participants. In this thesis we will be trying to consider and investigate the impact of each parameter or combination of parameter values upon the numerical outcomes of these ambush combat models.

In a recent study, Riddhiroj [5] applied Schaffer's ambush model to five different types of ambusher deployments with claymore tactics, selected from combat experiences. His five different types of ambushes used essentially the same tactics except for the locations of the ambushers and the ambush firing zones. The variation was achieved by changing appropriate parameter values in Schaffer's equations. The work in this thesis may be viewed as an extension of Riddhiroj's, in that we intend to investigate a wider range of parameters and determine the effects on ambush outcomes.

In the next chapter we will talk about the Lanchester basic equations or the attrition rate equations which are the basic concept of the ambush model, and then we will go on with Schaffer's equations and the uses of claymores. Chapter III is about the design of a sensitivity analysis for the model parameters. Numerical results are presented in Chapter IV. Chapter V, the last chapter, will be the

conclusion of this thesis and includes recommendations for further study. The appendix attached to this thesis gives the numerical ambush combat results obtained from the computer output.

II. THE AMBUSH MODEL

This chapter is concerned with models of ambush. Beginning with Lanchester's basic equations, an ambush combat model consisting of attrition rate equations by Schaffer will be presented. Then we will describe the changes to the Schaffer equations by Riddhiroj which brought claymore effects into the model.

A. LANCHESTER'S BASIC EQUATIONS

In 1914 F. W. Lanchester [4] tried to develop a quantitative combat representation through an idealized mathematical model of von Clausewitz's Principle of Concentration in modern warfare. In a combat scenario where each firing unit may take any enemy unit under fire, and once a unit destroys an enemy unit, it can immediately shift its fire to a new target, Lanchester postulated the following system of differential equations for combat beginning at time zero between two homogeneous forces with instantaneous force sizes X and Y:

$$\frac{dx}{dt} = -ay \tag{1}$$

and

$$\frac{dy}{dt} = -bx . \tag{2}$$

Here a is the "average" rate at which a single unit of y destroys x forces, b is "average" rate at which a single unit of x destroys y forces, and a and b are referred to as the Lanchester attrition-rate coefficients.

When (1) is divided by (2),

$$\frac{dx}{dt} \cdot \frac{dt}{dy} = \frac{-ay}{-bx}$$

or

$$bxdx = aydy .$$

Integration on both sides yields the following result:

$$b(x_o^2 - x^2) = a(y_o^2 - y^2) , \tag{3}$$

where x_o and y_o are the initial force sizes for force x and force y, respectively. This result (3) is called the Lanchester Square Law.

There is another type of Lanchester model which is called Lanchester Linear Law. This model results from the assumption of an area firing mode used by each force. The attrition rates for this model are

$$\frac{dx}{dt} = - a_1 xy \tag{4}$$

and

$$\frac{dy}{dt} = - b_1 xy . \tag{5}$$

By dividing and integrating in the manner of (3) we have

$$b_1(x_o - x) = a_1(y_o - y), \tag{6}$$

which is clearly a linear model.

A mixed linear-square law case for the ambush type of combat has been proposed by Deitchman [3]. This model is based on the fact that the ambusher force fires from concealed positions with the ambushee force in his full view. The ambushee force, in defending itself, fires at the area

it thinks the ambusher force occupies. Then for an ambushee force of size X and an ambusher force size Y, the attrition rates are:

$$\frac{dx}{dt} = -Ay \tag{7}$$

and

$$\frac{dy}{dt} = -Byx \tag{8}$$

where A and B are the attrition rate coefficients of the ambushee and ambusher forces, respectively. The above two differential equations yield the mixed model

$$2A(y_o - y) = B(x_o^2 - x^2) \tag{9}$$

where x_o and y_o are the initial ambushee and ambusher force sizes respectively. The attrition rate coefficient of the ambusher force, B, is taken to be the rate at which a single rifleman of the ambushee force kills the ambushers. Here

$$B = r_x \frac{A_e}{A_y},$$

where

r_x = rate of fire of each of the ambushee force weapons,

A_e = area of target which if hit would produce a casualty, and

A_y = total area which the targets occupy.

The attrition rate coefficient of the ambushee force X is A. Here,

$$A = r_y P_y,$$

where

r_y = rate of fire of each of the ambusher force's weapons, and

P_y = single-shot kill probability of the ambusher force's weapon in aimed fire.

B. SCHAFFER'S AMBUSH EQUATIONS

In Schaffer's paper [6], the term "ambush" is defined as a "surprise attack, causing weapon efficients on both sides to undergo rapid and significant change during the early stages of conflict." Besides this definition, Schaffer also mentions that in the absence of supporting weapons, the ambusher is usually successful against forces numerically 50 percent, and often 100 percent, larger. Even when the ambushee employs aggressive responsive tactics and ultimately causes the ambusher to break contact, the engagement can be a success for the ambusher, provided he breaks contact before the larger force can take proper advantage of its numbers.

Because of the surprise element in an ambush, defensive cover in initially minimal. As the engagement progresses, the ambushees seek whatever cover is available and gradually improve their situation. The attackers, on the other hand, have a relatively secure position which remains essentially unchanged until the contest ends (or until they choose to break off the engagement).

The ambushees generally enter the contest by engaging in area fire, because of their lack of preparation for the immediate conflict. However, as the battle unfolds, the defense maneuvers, attempts to locate the attackers, rushes the opponent's position if possible, and gradually switches

from area to armed fire. The ambushers, on the other hand, engage in aimed fire throughout, although its net quality deteriorates with time.

The Schaffer model for ambush involves two rather more extensive differential equations than the Deitchman formulation. For the ambushee side, the attrition rate is

$$\frac{dx}{dt} = -(1-b_x)k_y(t)y - c_x\left(\frac{y}{x}-1\right)^2 - (1-b_x)\sum_i E_i(t,x)W_i(t)$$

where $\sum_i E_i(t,x)W_i(t)$ reflects the support weapons of the ambusher force, and $k_y(t)$ is the ambusher small-arms weapon efficiency coefficient. Here,

$$k_y(t) = \frac{r_y A_T(t) P_{h,k}}{2\pi\sigma_y^2},$$

where r_y is the rate of fire of the ambusher force, $P_{h,k}$ is the conditional probability of kill given a hit, and σ_y is the radial dispersion of a single round fired by the ambusher. The probability that a single ambusher round hits the target may be represented as

$$\frac{A_T(t)}{2\pi\sigma_y^2},$$

where $A_T(t)$ is the area of the target through which the ambusher round must pass for a hit to be scored. In particular,

$$A_T(t) = \frac{A_T(\infty)}{1 - e^{-\alpha t-\beta}},$$

where $A_T(\infty)$ is the minimum final presented target area of an individual in steady state.

The factor b_x is a constant associated with troop discipline. This constant, b_x, is defined to be equal to or less than zero depending upon how well disciplined the troops are. A value close to zero indicates better discipline than values that are far below zero. A coefficient reflecting "desertions" associated with being outnumbered is $\dot{c}_x(t)$, for the ambusher, and the term $-c_x(t)(\frac{x}{y}-1)^2$ is taken to reflect the ambushee force's rate of withdrawal. The attrition rate contribution produced by the supporting weapons of the ambusher force is given by

$$\sum_i E_i(t,x)W_i(t),$$

where the E_i are the weapon efficiencies of the ambusher's i types of supporting weapons over time, and $W_i(t)$ reflects the strength of a supporting weapon strength of type i over time.

For the ambusher side,

$$\frac{dy}{dt} = -k_x(y,t)x - c_y(t)(\frac{x}{y}-1)^2 - \sum_j E_j(t,y)W_j(t),$$

where $k_x(y,t)$ is the weapon efficiency coefficient for the ambushee force, and $c_y(t)$ is the withdrawal coefficient.

Here

$$k_x(y,t) = k''(1-e^{-\gamma t}) + k'ye^{-\gamma t}$$

where

$$k' = r_x(\frac{A_e}{A_y})\, P_{h,k}$$

and

$$k'' = r_x(\frac{A_e}{2\pi\sigma_x^2})\, P_{h,k}.$$

When $t = 0$, the attrition rate coefficient, $k_x(y,t)$, takes the appropriate form for area fire, $k'y$, and when t is very large this coefficient takes the form for aimed fire k''. The constant γ reflects the rate at which the ambushee force can shift from area to aimed fire.

The term $c_y(t)(\frac{x}{y}-1)^2$ reflects the ambusher force's rate of withdrawal from ambush site. The withdrawal coefficient, $c_y(t)$ is interpreted by Schaffer as a step function which is dependent on both time and the ambushee-ambusher force ratio, and it is defined as

$$c_y(t) = |cy| \; [H(t-t_o)H(\frac{x}{y}-1)],$$

where H is a unit step function, t_o is the time required for the discipline of an ambusher to deteriorate to the point when he may desert, and c_y reflects the training and motivation of the ambushers. Thus, $c_y(t)$ is a positive value when $t_j > t_o$ and $\frac{x}{y} > 1$, and zero otherwise.

C. THE USE OF CLAYMORES

Explosives are often used by ambushers. Some of these explosives are the trap types such as the pressure trigger trap and the trip wire trap, and some are the ambusher-operated type such as the claymore and hand grenade. The use of explosives in an ambush is as part of the surprise while the ambushed force is still exposed, so that it will be easier to annihilate the rest of the enemy force by later small-arms fire.

Riddhiroj [5] introduced the use of claymores by the ambushers into Schaffer's model. He assumed that there were two men from the ambusher force who operated these claymores from a concealed position. These two men were assumed to be safe from the small-arms fire from the ambushee side and from the explosion of the claymores. The claymores were controlled to explode when the whole column of ambushees were in the ambusher's preselected killing zone.

The claymores used in this model by the ambushers were fired only once, at the beginning of the ambush engagement. Immediately after the claymores were fired, small-arms weapon fire from the ambusher began.

Because of the men controlling the claymores, the force size at the beginning of ambush engagement would be $(y_o - 2)$ where y_o was the total number of men belonging to the ambusher side. For the ambushee force, the initial strength was reduced in Riddhiroj's work to $x_o(1 - \overline{P}_k)$ due to the casualty caused by claymores. Here, $\overline{P}_k$ is the average kill probability (lethality) from the burst of the claymores.

Hence, the attrition rate equations of Schaffer when claymores are involved will be in the following forms. For ambushee side, we have

$$\frac{d(x-x_o\overline{P}_k)}{dt} = -(1-b_x)k_y(t)(y-2) - c_x\left(\frac{y-2}{x-x_o\overline{P}_k} - 1\right)^2$$

$$-(1-b_x)\sum_i E_i(t,x)W_i(t),$$

and for the ambusher side, we have

$$\frac{d(y-2)}{dt} = -k_x(y,t)(x-x_o\overline{P}_k)-c_y(t)\left(\frac{x-x_o\overline{P}_k}{y-2} - 1\right)^2$$

$$- \sum_j E_j(t,y)W_j(t) \; .$$

Here,

$$k_x(y,t) = k''(1 - e^{-\gamma t}) + k'(y-2)e^{-\gamma t}$$

where

$$k' = r_x\left(\frac{A_e}{A_y} \right)P_{h,k}$$

and

$$k'' = r_x\left(\frac{A_e}{2\pi\sigma_x^2} \right) P_{h,k} \; .$$

Now it can be seen that when the claymore tactic is added to Schaffer's model, the model remains in the same form except that the values of the force sizes are reduced from x to $x-x_o\overline{P}_k$ for the ambushees and y to y-2 for the ambushers. In the next chapter where the design of parameter analysis will be made, we'll talk about the measure of effectiveness, the assumptions made from the earlier thesis by Riddhiroj and the analysis methods used in this paper.

III. DESIGN OF SENSITIVITY ANALYSIS

In this chapter we will discuss the use of Schaffer's ambush model made by Riddhiroj and the special case of that ambush model which resulted. This forms the basis for the parameter sensitivity analysis in this paper. Our discussion of the design of the sensitivity analysis will include consideration of the parameters which were selected for our study and the measure of effectiveness used in the analysis.

A. AMBUSH GENERAL SCENARIO AND ASSUMPTIONS

In general, the ambush engagement takes place in the area selected by the ambushers, who will be waiting in a concealed position for their enemy. The force being ambushed cannot see the ambushers but they may realize that they might by surprised by ambushers at any time in this area. The ambushees, in defending themselves by returning fire to their enemy, fire first at the area they think the ambushers are occupying. They may call on supporting weapons or request help from supporting units in a rear area, but before supporting weapons or supporting units can help the ambusher may withdraw due to a fear of possible counterattack and fire from the ambusher's supporting units.

In this study, we assume that because of ambusher withdrawal, the ambush engagement will last no more than three minutes. Also we will follow Riddhiroj's assumption that the ambushers will have no supporting weapons. The troop discipline factor in the model will be assumed equal to zero

here, implying well-disciplined troops. With these assumptions, the attrition-rate equation for the ambushee force becomes

$$\frac{d(x-x_o\bar{P}_k)}{dt} = -k_y(t)(y-2) - c_x \left[\frac{(y-2)}{x-x_o\bar{P}_k} - 1\right]^2,$$

where

$$k_y(t) = \frac{r_y A_T(t) P_{h,k}}{2\pi\sigma_y^2}$$

and

$$A_T(t) = \frac{A_T(\infty)}{1 - e^{-\alpha t-\beta}} .$$

In the same manner as the ambushee force, we also assume that there are no supporting weapons for the ambushers. Then the attrition-rate equation for the ambusher side is reduced to

$$\frac{d(y-2)}{dt} = -k_x(y,t)(x-x_o\bar{P}_k) - c_y(t) \left[\frac{(x-x_o\bar{P}_k)}{y-2} - 1\right]^2$$

where

$$k_x(y,t) = k''(1 - e^{-\gamma t}) + k'(y-2)e^{-\gamma t},$$

$$k' = r_x\left(\frac{A_e}{A_y}\right) P_{h,k}$$

and

$$k'' = r_x\left(\frac{A_e}{2\pi\sigma_x^2}\right) P_{h,k} .$$

Note that the assumptions made in this model are the same as the assumptions made by Riddhiroj [5].

The attrition-rate equations given above are considered here to be a special case of Schaffer's ambush model and the

parameter analysis we are going to work with will be based on this special case. However, Schaffer's general model may be studied by the same approach that we use in this study.

B. PARAMETER ANALYSIS

The purpose of the analysis in this thesis is to investigate the variation of model predictions of ambush outcomes when the parameters in the model are numerically varied. Since the model we are working with is clearly non-linear, requires numerical solution, and involves many parameters, it is difficult to determine sensitivity to parameter by only inspection. Our work here will be to assign different plausible values to the parameters in model, and compute the predicted ambush results in terms of ambush measures of effectiveness. (These measures of effectiveness will be discussed later in this chapter.) The two techniques of parameter analysis to be used are described below.

1. Single Parameter Analysis

For this type of analysis, we will allow each parameter to take on its lower bound value and its upper bound value while the remainder of the parameters are kept fixed at the initial values that were assigned by Riddhiroj. In this work, we will point out the differences of the combat outcomes at the end of three minutes after the lower value and upper value of parameter have been tried and we will also keep the engagement going until one force is annihilated, to establish a "winner." Then, we will explain the remaining

ambush combat results, for example, the winner's force level and the total time to destroy the losing force.

2. 2^k Factorial Analysis

This method of analyzing parameters of the model is to vary them at the same time, permitting interactions to be studied. In a factorial analysis, the quantity of data which must be computed will depend on the number of parameters. If, for example, there are two parameters to be varied, each at maximum and minimum levels, then there will be four combinations:

1. 1st parameter is max, 2nd parameter is max
2. 1st parameter is max, 2nd parameter is min
3. 1st parameter is min, 2nd parameter is max
4. 1st parameter is min, 2nd parameter is min.

For three parameters, the number of numerical solutions to the model would be $8 = 2^3$, and so on. Thus, for k parameters in which each parameter is used at two levels, the number of trials needed will be 2^k. (Since the model is deterministic, replications are not needed.)

C. SELECTION OF PARAMETERS FOR ANALYSIS

Although the model is a special case, there still are many parameters involved. Let's consider our model again. We have

$$\frac{d(x-x_o\overline{P}_k)}{dt} = -k_y(t)(y-2) - c_x \left[\frac{(y-2)}{(x-x_o\overline{P}_k)} - 1\right]^2$$

where

$$k_y(t) = \frac{r_y A_T(t) P_{h,k}}{2\pi\sigma_y^2},$$

and

$$A_T(t) = \frac{A_T(\infty)}{1 - e^{-\alpha t - \beta}}$$

for the ambushee side, and

$$\frac{d(y-2)}{dt} = -k_x(y,t)(x - x_o\overline{P}_k) - c_y(t)\left[\frac{(x - x_o\overline{P}_k)}{(y-2)} - 1\right]^2,$$

where

$$k_x(y,t) = k''(1 - e^{-\gamma t}) + k'(y-2)e^{-\gamma t},$$

$$k' = r_x\left(\frac{A_e}{A_y}\right) P_{h,k},$$

and

$$k'' = r_x\left(\frac{A_e}{2\pi\sigma_x^2}\right) P_{h,k}.$$

We can list the parameters involved as follows:

x = ambushee force size

y = ambusher force size

r_x = firing rate of each of ambushee weapon (in rounds per minute)

r_y = firing rate of each of ambusher weapon (in rounds per minute)

$\overline{P}_k$ = average kill probability of claymore

$A_T(\infty)$ = minimum final presented area of the individual in a steady state (in square feet)

$P_{h,k}$ = probability of kill given a hit

σ_x = radial dispersion of a single round fired by ambushee (in mils)

σ_y = radial dispersion of a single round fired by ambusher (in mils)

α = speed at which the ambushee can approach the level of his maximum cover (in minute^{-1})

β = presented area of individual at the instant the ambush begins

A_e = the area of target which would produce casualty (in square feet)

γ = rate at which the ambushee can shift from area to aimed fire (in minute^{-1})

t = time of engagement (in minutes).

A_y = total area which the targets (ambushers) occupy (in square yards)

$c_x(t)$ = a constant associated with ambushee troop discipline

$c_y(t)$ = a constant associated with ambusher troop discipline.

We can see that there are 17 parameters in our model. At this point the number of trials for our 2^k factorial analysis will be 2^{17} which is a very large number. Instead of doing all 2^{17} combinations we will reduce number of trials to a smaller number by pre-computing some terms in the early stage of analysis. For example, we will attempt to compute the maximum and minimum values of k', k" first and use these values in the model as parameter values in the analysis. The values of x_o, the ambushee force size, and y_o, the ambusher force size will be kept constant as will $\overline{P}_k$ and t.

Finally, the parameters selected for our analysis will be the following:

r_y

$A_T(\infty)$

α

β

γ

k' where $k' = r_x(\frac{A_e}{A_y})P_{h,k}$

k'' where $k'' = r_x(\frac{A_e}{2\pi\sigma_x^2})P_{h,k}$

c_y.

With the number of parameters involved our analysis study reduced to eight, the factorial analysis in our work will consist of only $2^8 = 256$ trials. Here, for some parameter such as r_x, A_e, A_y, $P_{h,k}$ and σ_x, maximum and minimum values are pre-selected and substituted in k' and k" so that early analysis work will be dealing with only the values of k' and k". The maximum and minimum values of k' and k" then will be brought into use as mentioned earlier.

D. MEASURES OF EFFECTIVENESS

In the ambush, the time-dependence of the weapon efficiency coefficient is important. This time dependence results from the changing cover available to individuals on the ambushee side and also the defense's gradual transition from area to aimed fire as it responds to the attack. With the attrition model, ambush results are computed in the form of force sizes for the two opponents at various points in time during the engagement. For ambush measures of effectiveness to be used as dependent variables in the sensitivity analysis, we will have the following:

1. The ambusher force level at time t of engagement.
2. The ambushee force level at time t of engagement.
3. The ambushee-ambusher force ratio at time t of engagement.

Each of these measures of effectiveness will be considered at three points in time during the engagement, namely at 2.0, 2.5, and 3.0 minutes of combat duration.

Up to here, we have not assigned numerical values for these parameters. This will be done in the next chapter where we will also show some numerical results of our computation work obtained from the computer output.

IV. THE SENSITIVITY ANALYSIS

We have introduced the parameters which will be examined in terms of their impacts on designated measures of effectiveness for ambush combat. In this chapter, these parameters will be assigned various values and the sensitivity of the effectiveness measures to the parameters measured. The values which these parameters can take on are based upon values from Parameter Estimates for Mathematical Models of Convoy Ambushes, by Burnell [2], from which plausible high and low values were estimated. We will first discuss the input and results of the single variable analysis, and then give the results of the 2^k factorial analysis, where k is the number of parameters to be analyzed.

A. INPUTS FOR THE SINGLE VARIABLE ANALYSIS

For the single variable analysis, we want to know what happens where only one parameter is increased or decreased from the values used by Riddhiroj (and suggested by Burnell), and we have tried to select values which are plausible. Table I shows selected lower and upper parameter values. These values were selected to bracket the values used in Riddhiroj's thesis, which are also shown in the table.

Other parameters for which values used by Riddhiroj remain unchanged are

x = 30 (ambushee force size before they are attacked by claymores)

y = 7 (total number of men on the ambusher side)

Table I. Lower and Upper Parameter Values Used in the Single Variable Analysis.

Parameters	Lower Values	Riddhiroj Values Suggested by Burnell	Upper Values
$A_T(\infty)$ - Minimum target area presented by one man, sq. ft.	1.3	1.68	1.9
α - Rate of obtaining cover parameter, min^{-1}	0.2	0.572	0.9
β - Initial target size parameter	0.1	0.4	0.8
γ - Rate of changing mode of fire parameter, min^{-1}	0.425	0.516	0.575
$P_{h,k}$ - Probability of kill given a hit	0.65	0.8	0.92
A_y - Area occupied by target, sq. yd.	730	1000	1200
r_x, r_y - Rate of fire, rounds per min.	10	20	40
$k' = r_x\left(\frac{A_e}{A_y}\right)P_{h,k}$	0.00048	0.00096	0.00192
$k'' = r_x\left(\frac{A_e}{2\pi\sigma_x^2}\right)P_{h,k}$	0.0378	0.0756	0.1512

$\overline{P}_k$ = 0.518 (average kill probability resulting from the explosion of claymores)

$c_x(t)$ = 0 (desertion coefficient of the ambushee force)

$c_y(t)$ = 1 (desertion coefficient of the ambusher force)

$\sigma_x = \sigma_y$ = 10 mils (round dispersion)

A_e = 0.54 square feet (area of target which would produce a casualty).

B. RESULTS OF THE SINGLE VARIABLE ANALYSIS

A computer program solving the ambush attrition rate equations was used for the single variable analysis. Results in terms of force size status at t = 3.0 min. are summarized in Table II and discussed below.

1. Variation in Minimum Target Area Presented by One Man, $A_T(\infty)$

The suggested value by Burnell [2] for $A_T(\infty)$ is 1.68 sq. ft., and we additionally tried 1.3 sq. ft. (value initially estimated by Burnell) and 1.9 sq. ft. (a possible value obtained by estimation). Since $A_T(\infty)$ is the numerator of the equation

$$\frac{d(x-x_o\overline{P}_k)}{dt} = -\left[\frac{r_y A_T(\infty) P_{h,k}}{2\pi\sigma_y^2(1 - e^{-\alpha t-\beta})}\right](y-2) ,$$

the ambushee attrition rate proportional to $A_T(\infty)$. The ambush combat result at the end of 3.0 minutes of engagement time is that the ambushee force size is reduced from 30 men to 7.698 when $A_T(\infty)$ = 1.30 is used and to 4.394 when $A_T(\infty)$ = 1.90.

The variation in $A_T(\infty)$ does not only affect the attrition rate of ambushee force, but also affects the attrition rate

Table II. Summarized Ambush Outcomes at t = 3.0 Min. for the Single Variable Parameter Analysis.

Parameters	Parameter Values	Ambush Status at 3 Min. Ambusher Force Size	Ambushee Force Size	Asbushee-Ambusher Force Ratio
	Lower=1.3	5.561	7.698	1.384
$A_T(\infty)$	1.68	5.748	5.618	0.977
	Upper=1.9	5.858	4.394	0.750
	Lower=0.2	6.269	0	0
α	0.572	5.748	5.618	0.977
	Upper=0.9	5.665	6.470	1.142
	Lower=0.1	5.860	4.611	0.786
β	0.4	5.748	5.618	0.977
	Upper=0.8	5.611	6.881	1.213
	Lower=0.425	5.880	5.40	0.918
γ	0.516	5.748	5.618	0.977
	Upper=0.575	5.672	5.693	1.003
	Lower=0.65	5.592	7.346	1.313
$P_{h,k}$	0.8	5.748	5.618	0.977
	Upper=0.92	5.873	4.214	0.717
	Lower=730	5.726	5.646	0.986
A_y	1000	5.748	5.618	0.977
	Upper=1200	5.758	5.607	0.973

of the ambusher side, indirectly through X. For example with $A_T(\infty) = 1.3$, computer results (Appendix) show that at the end of 5.5 min. of engagement time the number of men on the ambusher side remains 2 (all ambushers were killed except the two men who control claymores) while with less cover available ($A_T(\infty) = 1.9$) the ambushee force at that time is annihilated instead of the ambushers. This suggests that the amount of available cover for the ambushed force may indeed influence ambush outcomes. It affects the ambushee side

directly and affects the ambusher side indirectly; the values shown in Table II are indicative of the benefits to the ambushee of increasing his eventual cover (decreasing $A_T(\infty)$).

2. <u>Variation in the Rate of Obtaining Cover Parameter, α</u>

The high and low values used for α, the parameter controlling the rate at which ambushees take cover, correspond to achievement of 98% of individual cover at three minutes ($\alpha = 0.9$) and 71% of eventual cover at that time ($\alpha = 0.2$). Although these percentages both seem high, computer results show that with the lower value the ambushees will have been defeated at three minute point, while with the higher value they will retain a slight numerical advantage at this time. Riddhiroj's value of $\alpha = 0.572$ corresponds to a gain of 93% of eventual cover at the three minute point, and gives the ambushers a numerical advantage at that time.

3. <u>Variation in the Initial Target Size Parameter, β</u>

The parameter β controls the size of targets (ambushees) at the beginning of the engagement ($A_T(0)$). With an eventual target size of $A_T(\infty) = 1.68$ sq. ft., the β values used in our single variable analysis correspond to initial target sizes as follows:

β	$A_T(0)$
0.1	16.8 sq. ft.
0.4	5.1 sq. ft.
0.8	3.1 sq. ft.

The computer output of ambush combat shows that at the time 3.0 min. where $\beta = 0.1$ the ambushee force size is 4.611 but when $\beta = 0.8$ the force size turns out to be 6.881. The parameter has very little influence on ambusher force size, but the effects on ambushees cause pronounced reversals in the force ratio at three minutes.

Let us look at $A_T(3)$, the exposed area of the target at time $t = 3.0$ min. We let the parameter α vary from 0.2 to 0.9 and β vary from 0.1 to 0.8. When α varies we will keep β fixed at $\beta = 0.4$ and when β varies we will keep α fixed at $\alpha = 0.572$. Table III shows the different results in terms of values of $A_T(3)$ and ambushee force size at $t = 3.0$ min. Here we see the benefits to the ambushee of either having large initial cover or acquiring cover rapidly.

Table III. Ambushee Target Sizes Used in Analysis.

		$A_T(3)$	Ambushee Force Size at $t = 3.0$
$\beta = 0.4$	$\alpha = 0.2$	2.658	0
	$\alpha = 0.9$	1.759	6.47
$\alpha = 0.572$	$\beta = 0.1$	2.007	4.61
	$\beta = 0.8$	1.828	6.88

4. <u>Variation in the Rate of Changing Mode of Fire Parameter, γ</u>

The parameter γ controls the rate at which the ambushee changes from area fire to aimed fire. With the same firing rate, the chance of hitting a target in the aimed fire mode is bigger than in the area fire mode. Thus, the

bigger value of γ (higher percentage of aimed fire at time t) the more casualties the ambushers will obtain. The numerical results in Table II show that changing the value of γ from 0.425 to 0.575 has relatively little effect on force levels at time 3.0 min.

5. Variation in the Probability of Kill Given a Hit, $P_{h,k}$

It is clear that when we increase this probability of kill given a hit we will also increase the attrition rate. (In this ambush, it is reasonable to assume that the probabilities of kill given a hit for both sides are equal since both forces use small-arms weapons.) But the rate at which rounds hit targets is not the same for the two forces due to differences in type of fire. The ambushee's use of area fire at the beginning of engagement and gradual change to aimed fire afterwards is considered to be a disadvantage in a short engagement. Looking at ambush status at time t = 3.0 min., we have data to suggest that for small values of $P_{h,k}$ the advantage belongs to the ambushee side and for bigger values of $P_{h,k}$ the advantage belongs to the ambusher side. The numerical results from Table II show that when $P_{h,k} = 0.65$ the ambushee-ambusher force ratio is 1.313, but when $P_{h,k} = 0.92$ the force ratio turns out to be 0.717. This was due almost exclusively to ambushee attrition, since the ambusher force size at three minutes was only slightly affected by the changes in $P_{h,k}$.

6. Variation in the Area Occupied by Target, A_y

Varying the area containing the ambushers did not have much effect on attrition of either force. However, the bigger area the ambushers occupy, the lower their attrition rate, as expected. From the table when A_y = 730 square yards, the ambusher force level at three minutes is 5.726 while when A_y = 1200 square yards, the ambusher force level becomes 5.758.

7. Composite Variation in A_e, r_x, r_y, k' and k"

Since we have

$$k' = r_x\left(\frac{A_e}{A_y}\right)P_{h,k}$$

and

$$k'' = r_x\left(\frac{A_e}{2\pi\sigma_x^2}\right)P_{h,k}$$

the values of k' and k" will depend $P_{h,k}$, A_e, A_y, r_y and σ_x^2. Here, we used upper values and lower values of these parameters and determined the low and high values of k' and k". The low and high values of k' and k" were used in the equation to compute the ambush outcomes.

Table IV. Effects of Attrition Coefficient on Force Level.

	Ambushee Force Level	Ambusher Force Level	Ambushee-Ambusher Force Ratio
k' = 0.00048 k" = 0.0378 r_x = 10, r_y = 20	5.190	6.383	0.813
k' = 0.00192 k" = 0.1512 r_x = 40, r_y = 20	10.89	3.60	3.025

The numerical results are shown in Table IV together with different values of k', k", r_x and r_y used as inputs. The term A_e is kept constant in this computation.

C. RESULTS OF THE 2^k FACTORIAL ANALYSIS

In a factorial analysis the effects of a number of different parameters are investigated simultaneously. The set of treatments consists of all combinations that can be formed from different parameter values. Here, the number of parameters or k is eight and each parameter has two different values or what we shall call two levels. There were 2^8 or 256 combinations of combat engagement results investigated, as discussed in the previous chapter.

For multivariate analysis, 256 ambush combat outcomes were precomputed using all possible variations of eight parameters. Factorial analysis was done for each m.o.e., at each combat time studied, e.g., the outcomes of ambushee force level at the time t = 2.0 min.

The computer program used for this 2^k factorial analysis is called BIOMEDO2V. Details about this input and output are given in Appendix A.

The maximum and minimum values used for each parameter are, in this case, different from the upper and lower values of the single variable analysis and are shown in Table V. The reason for using different values is that we wish combinations of extreme values of the parameters, rather than a mid-range values used in the single variable analysis.

Table V. Numerical Upper and Lower Values of Parameters in Factorial Analysis.

Parameter	Upper Values	Lower Values
r_y	40	10
$A_T(\infty)$	2.0	0.1
α	6.2	0.1
β	2.0	0.1
γ	0.80	0.102
k'	0.00192	0.00048
k''	0.1512	0.0378
c_y	1.0	0

Our analysis center on the portion of the BIOMEDO2V program output providing mean square values for each source of variation. These are partially summarized in the tables below. Table VI will show the result of our analysis at ambush time t = 2.0 min. Table VII and Table VIII will show the results for t = 2.5 min and t = 3.0 min, respectively. Other details of the results can be seen in the appendices.

The output of BIOMEDO2V program shows the sums of squares and mean squares, and since our data is determinate, no statistical interpretation is made. We can interpret this output by inspecting the sums of square values for each source of variation. The bigger number indicates the greater significance of that variable (parameter). Thus we can determine the sensitivity to each parameter readily.

Table VI. Results of Sensitivity Analysis at Ambush Time $t = 2.0$.

	Computed Mean Squares		
Variables	Ambushee Force Size	Ambusher Force Size	Ambusher-Ambushee Force Ratio
1. Ambusher firing rate, r_y	3.27	911.80	29.58
2. Min final presented area of target, $A_T(\infty)$	12.26	4162.05	138.73
3. Max cover approaching speed, α	2.08	340.85	10.79
4. Initial presented area of target, β	1.42	221.34	7.01
5. Rate of shifting firing mode, γ	74.08	6.067	15.38
6. $k' = r_x(\frac{A_e}{A_y})P_{h,k}$	0.48	0.002	0.05
7. $k'' = r_x(\frac{A_e}{2\pi\sigma_x^2})P_{h,k}$	68.64	3.353	15.17
8. Withdrawal coefficient, $c_y(t)$	0.0	0.0	0.0
Interactions	Mean Squares > 1.5	Mean Squares > 1.5	Mean Squares > 1.5
1,2	2.28	571.58	17.32
1,3	--	17.01	--
1,4	--	42.95	--
2,3	--	176.66	4.93
2,4	--	99.19	2.74
2,5	3.58	3.51	2.07
2,7	3.83	4.65	1.91
3,4	--	220.14	7.01
5,7	32.33	4.75	9.42
1,2,3	--	52.58	1.91
1,2,4	--	90.07	2.98
1,3,4	--	43.21	--
2,3,4	--	98.127	2.69
2,5,7	--	3.10	--
1,2,3,4	--	90.79	3.00

Table VII. Results of Sensitivity Analysis at Ambush Time $t = 2.50$.

Variables	Ambushee Force Size	Ambusher Force Size	Ambushee-Ambusher Force Ratio
	Computed Mean Squares		
1. Ambusher firing rate, r_y	4.92	1204.39	48.44
2. Min final presented area of target, $A_T(\infty)$	21.25	5338.41	231.72
3. Max cover approaching speed, α	2.16	257.39	10.73
4. Initial presented area of target, β	4.36	198.93	7.07
5. Rate of shifting firing mode, γ	129.87	11.21	40.37
6. $k' = r_x(\frac{A_e}{A_y})P_{h,k}$	1.63	0.05	0.21
7. $k'' = r_x(\frac{A_e}{2\pi\sigma_x^2})P_{h,k}$	107.94	10.31	40.42
8. Withdrawal coefficient, $c_y(t)$	0	0	0

Interactions	Mean Squares > 3.0	Mean Squares > 3.0	Mean Squares > 3.0
1,2	--	752.24	24.69
1,3	--	58.71	--
1,4	--	76.62	--
1,7	4.04	--	--
2,3	--	104.81	3.36
2,4	3.83	73.59	--
2,5	4.15	6.02	8.27
2,7	13.34	5.54	8.51
3,4	--	197.43	7.64
5,7	46.13	--	28.80
1,2,3	--	124.34	5.99
1,2,4	--	145.82	6.39
1,2,7	4.07	--	--
1,3,4	--	77.17	--
2,3,4	3.77	72.57	--
2,5,7	4.99	3.77	6.67
1,2,3,4	--	146.70	6.16

Table VIII. Results of Sensitivity Analysis at Ambush Time $t = 3.0$.

Variables	Ambushee Force Size	Ambusher Force Size	Ambushee-Ambusher Force Ratio
	Computed Mean Squares		
1. Ambusher firing rate, r_y	61.61	1270.61	183.57
2. Min final presented area of target, $A_T(\infty)$	513.38	0019.58	1492.46
3. Max cover approaching speed, α	40.36	242.36	59.03
4. Initial presented area of target, β	17.33	193.40	32.89
5. Rate of shifting firing mode, γ	55.69	29.82	57.51
6. $k' = r_x\left(\frac{A_e}{A_y}\right)P_{h,k}$	1.08	0.41	0.0
7. $k'' = r_x\left(\frac{A_e}{2\pi\sigma_x^2}\right)P_{h,k}$	49.18	29.73	50.12
8. Withdrawal coefficient, $c_y(t)$	30.70	2.84	33.31

Interactions	Mean Squares > 5	Mean Squares > 5	Mean Squares > 5
1,2	39.43	286.51	67.55
1,3	--	71.69	--
1,4	--	74.32	--
1,5	--	--	8.49
1,7	5.78	--	5.65
2,3	7.29	78.50	--
2,4	--	57.97	--
3,4	21.79	192.31	43.76
5,7	--	21.49	--
5,8	5.91	--	7.23
7,8	6.49	--	10.07
1,2,3	7.61	167.91	41.88
1,2,4	7.79	165.23	35.20
1,2,5	--	--	9.33
1,2,7	6.94	--	12.61
1,2,8	--	--	6.48
1,3,4	--	74.72	--
1,7,8	--	--	--

Table VIII. Continued.

Interactions	Mean Squares > 5	Mean Squares > 5	Mean Squares > 5
2,3,4	--	57.90	--
2,3,5	--	--	5.38
2,3,7	--	--	7.08
2,3,8	--	--	5.55
2,5,7	8.01	--	9.67
2,5,8	--	--	7.01
2,7,8	--	--	8.68
1,2,3,4	--	164.98	24.59
2,5,7,8	10.98	--	18.48
1,2,5,7,8	10.03	--	14.57
2,4,5,7,8	--	--	5.10
1,3,4,5,7,8	--	--	5.39

Tables VI, VII, and VIII summarize results from the output of the BIOMEDO2V program. We can obtain a measure of the sensitivity of m.o.e. to each of the parameter and interactions by inspecting the values of mean squares. A bigger value of mean square indicates a higher sensitivity to that parameter or interaction. Higher order interactions which had very small mean squares are omitted from these tables. In the following, a discussion of the numerical results will be presented, categorized by the time-measure of effectiveness categories.

1. Ambush Force Status at 2 Min

Table VI shows computer output results of our parameter sensitivity analysis when the combat engagement has lasted 2 min. Here among the pure, non-interactive factors, ambushee force size at two minutes seems most sensitive to

the ambushee's rate of changing of firing mode, γ. Other significant factors include the attrition coefficient for aimed fire, k", and the interaction between this and γ. Factors such as initial presented target area and withdrawal coefficient, have small values of mean squares compared to others.

2. Ambusher Force Status at 2 Min.

For this ambusher force the most significant factor is the minimum final present area of target, $A_T(\infty)$, the next most significant one is the ambusher firing rate, r_y for the pure factors. The interaction between $A_T(\infty)$ and r_y is the most significant one among those non-pure factors. Again, the factor of the withdrawal coefficient, $c_y(t)$ is the least significant factor, having no effect at the time of engagement.

3. Ambushee-Ambusher Force Ratio at 2 Min.

Here the factor $A_T(\infty)$ which has the most effect for the ambusher force remains the most significant factor. The ambusher rate of fire, r_y which is the next most significant factor for the ambusher force size is also the next most significant factor for the ambushee-ambusher force ratio. The withdrawal coefficient factor, $c_y(t)$ continues to be the least significant one.

4. Ambushee Force Status at 2.50 Min.

The most significant of pure factors at 2.5 minutes are the same as those for the ambushee force status at 2.0 minutes. The difference noticed in this category is that the computed mean square values are bigger than those mean square values in the 2 minutes category for the most significant

factor in which this can reasonably imply that a greater dispersion is present. The non-significant factor, $c_y(t)$ still has the same computed mean square value. Notice that the computed mean square value for minimum final presented area of target increases rapidly when time increases.

5. Ambusher Force Status at 2.5 Min.

At 2.5 minutes, ambusher force status yields the same results as the ambusher force status at 2.0 minutes. Here, again the computed mean square values are larger than those in the 2 minute category.

6. Ambushee-Ambusher Force Ratio at 2.5 Min.

The results for this category are the same as in 3 except for higher values of the computed mean square.

7. Ambushee Force Status at 3.0 Min.

After three minutes of combat duration, the most significant factor turns out to be the minimum final presented area of target factor, $A_T(\infty)$, instead of the rate of shifting firing mode, γ. The ambusher firing rate, r_y and the rate of shifting firing mode γ became the second and third most significant factors, respectively. The withdrawal coefficient factor is not the least significant pure factor any more, being replaced by attrition coefficient for area fire. The interaction between the ambusher firing rate r_y, and the minimum final presented area of target $A_T(\infty)$ was the most significant pair among two factor and higher level interactions.

8. Ambusher Force Status at 3.0 Min.

For this category the factors $A_T(\infty)$, r_y and α are the most, second and third significant factors respectively

for the pure-noninteractive factors. The attrition coefficient for the area fire is the least significant factor as it is in the ambushee force status category. Also for the interactive factors, the interaction between $A_T(\infty)$ and r_y is the most significant one for the interaction kinds.

9. Ambushee-Ambusher Force Ratio at 3.0 Min.

This category has the same results as those in 8 above.

In this chapter we showed the results of our two parameter analysis approaches. The values of each parameter used in the single variable analysis may differ from those in the second approach but it will not seriously alter our conclusions since in the first approach we only want to tell the effects on the model when each parameter is varied separately. In the next chapter we will conclude the analysis and make some recommendations for further studies in this area.

V. CONCLUSION AND EXTENSIONS

In this Schaffer's ambush combat model parameter analysis, we included the claymore tactic from Riddhiroj's study so that the scenario will be more realistic when it is considered against the actual ambush combats in the jungle warfare or guerrilla warfare in Southeast Asia. The numerical values of parameters used in this study are obtained from Burnell's "Parameter Estimates for Mathematical Models of Convoy Ambushes." Theoretically estimated maximum and minimum values of these parameters appear unavailable for use in this analysis study. Since only plausible maximum or minimum values of parameters were used the results of our analysis cannot be the best result unless the proper maximum and minimum values are used. But a purpose of this study is to show the method of sensitivity analysis for this ambush combat model, so reasonable approximated values are introduced and used in here.

Our recommendation for a next study would be a variable by variable analysis to obtain better estimates of high and low values for each parameter. These values could then be used for future parameter sensitivity studies of ambush combat models.

It is hoped that the work presented in this thesis will be useful to those who are involved with mathematical models of ambush combat.

APPENDIX A

The computer program BIOMED02V was used in our work to perform an analysis of variance for our factorial design, with input data consisting of nine sets of 256 different values of ambush combat outcomes. (Note that there are nine sets of data because of three different engagement times, t = 2.0 min., t = 2.5 min., and t = 3.0 min, and three measures of effectiveness: the ambusher force size, the ambushee force size, and the ambushee-ambusher force ratio.) The form of data input, for example, the 256 values of ambushee force levels at time t = 2.0 min., is illustrated in the following, which consists of eight parameters, each at two levels.

The data may be represented in the form:

$x_{rabcdefgh}$

r = 1 (Replicate)

a = 1,2

b = 1,2 (Variables)

.

.

.

h = 1,2

The program will consider the variable (parameter)

a as our first parameter

b as our second parameter

.

.

.

and h as our eighth parameter.

In preparing data for analysis the data is placed in the following order:

$X_{r11111111}$

$X_{r11111112}$

$X_{r11111121}$

$X_{r11111122}$

$X_{r11111211}$

$X_{r11111212}$

.

.

.

$X_{r22222222}$ where r = 1.

Here our a, b, c, d, e, f, g and h represent r_y, $A_T(\infty)$, α, β, γ, k', k" and c_y respectively. When a = 1, it means a maximum value of r_y, and, when a = 2, a minimum value of r_y. This is if the data value notation is $X_{r21121221}$, it means that this value is the result of ambush combat when

r_y is min

$A_T(\infty)$ is max

α is max

β is min

γ is max

k' is min

k" is min and

c_y is max.

APPENDIX B: NUMERICAL RESULTS OF SINGLE VARIABLE ANALYSIS

$A_T(\infty) = 1.30$

Time (Min)	Ambushers Force	Ambushed Force	Ambushed-Ambusher Force Ratio
0.0	7.000	30.000	4.286
0.5	6.815	12.791	1.877
1.0	6.584	11.457	1.740
1.5	6.331	10.331	1.632
2.0	6.070	9.350	1.540
2.5	5.811	8.480	1.459
3.0	5.561	7.698	1.384
3.5	5.322	6.988	1.313
4.0	5.097	6.341	1.244
4.5	4.888	5.746	1.176
5.0	4.116	5.235	1.272
5.5	2.000	4.976	2.488

$A_T(\infty) = 1.9$

0.0	7.000	30.000	4.286
0.5	6.821	12.020	1.762
1.0	6.611	10.064	1.522
1.5	6.397	8.402	1.313
2.0	6.194	6.937	1.120
2.5	6.012	5.613	0.934
3.0	5.857	4.394	0.750
3.5	5.733	3.251	0.567
4.0	5.641	2.164	0.384
4.5	5.585	1.115	0.200
5.0	5.204	0.138	0.027
5.5	4.596	0.0	0.000

$\alpha = 0.2$

0.0	7.000	30.000	4.286
0.5	6.826	11.265	1.650
1.0	6.640	8.419	1.268
1.5	6.475	5.861	0.905
2.0	6.351	3.531	0.556
2.5	6.280	1.374	0.219
3.0	6.269	0.0	0.0

$\alpha = 0.9$

0.0	7.000	30.000	4.286
0.5	6.817	12.534	1.839
1.0	6.593	10.994	1.667

$\alpha = 0.9$ Continued

Time (Min)	Ambushers Force	Ambushed Force	Ambushed-Ambusher Force Ratio
1.5	6.353	9.675	1.523
2.0	6.112	8.505	1.391
2.5	5.881	7.445	1.266
3.0	5.665	6.470	1.142
3.5	5.469	5.565	1.017
4.0	5.296	4.716	0.890
4.5	5.147	3.913	0.760
5.0	4.997	3.154	0.631
5.5	4.869	2.432	0.500
6.0	4.726	1.746	0.369
6.5	4.531	1.102	0.243
7.0	4.246	0.516	0.121
7.5	3.827	0.014	0.004
8.0	3.189	0.0	0.0

$\beta = 0.1$

0.0	7.000	30.000	4.286
0.5	6.823	11.838	1.735
1.0	6.617	9.893	1.495
1.5	6.406	8.304	1.296
2.0	6.204	6.937	1.118
2.5	6.020	5.720	0.950
3.0	5.860	4.611	0.787
3.5	5.727	3.582	0.625
4.0	5.622	2.610	0.464
4.5	5.548	1.680	0.303
5.0	5.274	0.808	0.153
5.5	4.861	0.030	0.006
6.0	4.235	0.0	0.0

$\beta = 0.8$

0.0	7.000	30.000	4.286
0.5	6.815	12.816	1.881
1.0	6.585	11.373	1.727
1.5	6.335	10.084	1.592
2.0	6.083	8.920	1.466
2.5	5.840	7.857	1.346
3.0	5.611	6.881	1.226
3.5	5.402	5.978	1.107
4.0	5.215	5.136	0.985
4.5	5.051	4.346	0.860
5.0	4.852	3.608	0.744
5.5	4.703	2.918	0.620
6.0	4.579	2.266	0.495
6.5	4.445	1.648	0.371
7.0	4.264	1.070	0.251
7.5	4.002	0.546	0.136
8.0	3.618	0.100	0.028
8.5	3.041	0.0	0.0

$\gamma = 0.425$

Time (Min)	Ambushers Force	Ambushed Force	Ambushed-Ambusher Force Ratio
0.0	7.000	30.000	4.286
0.5	6.841	12.299	1.798
1.0	6.649	10.558	1.588
1.5	6.446	9.074	1.408
2.0	6.244	7.764	1.243
2.5	6.053	6.580	1.087
3.0	5.880	5.493	0.934
3.5	5.728	4.480	0.782
4.0	5.601	3.524	0.629
4.5	5.500	2.613	0.475
5.0	5.331	1.748	0.328
5.5	5.084	0.941	0.185
6.0	4.715	0.215	0.046
6.5	4.161	0.0	0.0

$\gamma = 0.575$

Time (Min)	Ambushers Force	Ambushed Force	Ambushed-Ambusher Force Ratio
0.0	7.000	30.000	4.286
0.5	6.805	12.306	1.808
1.0	6.573	10.586	1.611
1.5	6.330	9.133	1.443
2.0	6.093	7.863	1.290
2.5	5.872	6.727	1.146
3.0	5.672	5.693	1.004
3.5	5.497	4.738	0.862
4.0	5.349	3.845	0.719
4.5	5.228	3.001	0.574
5.0	5.090	2.202	0.433
5.5	4.912	1.449	0.295
6.0	4.655	0.755	0.162
6.5	4.273	0.141	0.033
7.0	3.700	0.0	0.0

$P_{h,k} = 0.65$

Time (Min)	Ambushers Force	Ambushed Force	Ambushed-Ambusher Force Ratio
0.0	7.000	30.000	4.286
0.5	6.816	12.708	1.864
1.0	6.587	11.307	1.716
1.5	6.338	10.123	1.597
2.0	6.084	9.090	1.494
2.5	5.833	8.173	1.401
3.0	5.592	7.346	1.313
3.5	5.366	6.593	1.229
4.0	5.155	5.902	1.145
4.5	4.962	5.263	1.061
5.0	4.510	4.693	1.040
5.5	3.931	4.226	1.075
6.0	2.000	3.926	1.963

$P_{h,k} = 0.92$

Time (Min)	Ambushers Force	Ambushed Force	Ambushed-Ambusher Force Ratio
0.0	7.000	30.000	4.286
0.5	6.821	11.979	1.756
1.0	6.613	9.990	1.511
1.5	6.401	8.298	1.296
2.0	6.201	6.807	1.098
2.5	6.023	5.458	0.906
3.0	5.873	4.214	0.718
3.5	5.755	3.046	0.529
4.0	5.671	1.933	0.341
4.5	5.623	0.857	0.152
5.0	5.186	0.0	0.0

$A_y = 730$

0.0	7.000	30.000	4.286
0.5	6.811	12.305	1.807
1.0	6.589	10.581	1.606
1.5	6.357	9.121	1.435
2.0	6.130	7.842	1.279
2.5	5.918	6.694	1.131
3.0	5.726	5.646	0.986
3.5	5.557	4.676	0.841
4.0	5.415	3.767	0.696
4.5	5.299	2.906	0.548
5.0	5.156	2.089	0.405
5.5	4.963	1.321	0.266
6.0	4.679	0.616	0.132
6.5	4.257	0.001	0.000
7.0	3.615	0.0	0.0

$A_y = 1200$

0.0	7.000	30.000	4.286
0.5	6.822	12.302	1.803
1.0	6.607	10.573	1.600
1.5	6.380	9.106	1.427
2.0	6.157	7.819	1.270
2.5	5.947	6.663	1.120
3.0	5.758	5.607	0.974
3.5	5.591	4.628	0.828
4.0	5.451	3.710	0.681
4.5	5.338	2.838	0.532
5.0	5.190	2.012	0.388
5.5	4.986	1.237	0.248
6.0	4.684	0.529	0.113
6.5	4.236	0.0	0.0

APPENDIX C: FORCE STATUS AT 2.0 MIN OF ENGAGEMENT.

Ambusher	Ambushee	Ambushee/Ambusher
5.180	4.995	0.964
5.180	4.995	0.964
6.528	3.390	0.519
6.528	3.390	0.519
5.232	4.915	0.939
5.232	4.915	0.939
6.577	3.309	0.503
6.577	3.309	0.503
6.532	3.358	0.514
6.532	3.358	0.514
6.776	3.075	0.454
6.776	3.075	0.454
6.642	3.200	0.482
6.642	3.200	0.482
6.885	2.916	0.424
6.885	2.916	0.424
5.182	4.979	0.961
5.182	4.979	0.961
6.528	3.372	0.517
6.528	3.372	0.517
5.234	4.899	0.936
5.234	4.899	0.936
6.578	3.291	0.500
6.578	3.291	0.500
6.533	3.340	0.511
6.533	3.340	0.511
6.776	3.057	0.451
6.776	3.057	0.451
6.643	3.182	0.479
6.643	3.182	0.479
6.885	2.898	0.421
6.885	2.898	0.421
5.381	3.740	0.695
5.381	3.740	0.695

Ambusher	Ambushee	Ambushee/Ambusher
6.703	0.0	0.0
6.703	0.0	0.0
5.431	3.659	0.674
5.431	3.659	0.674
6.628	2.120	0.320
6.628	2.120	0.320
6.899	1.744	0.253
6.899	1.744	0.253
6.689	2.012	0.301
6.689	2.012	0.301
6.801	1.988	0.292
6.801	1.988	0.292
6.589	2.167	0.329
6.589	2.167	0.329
6.839	0.0	0.0
6.839	0.0	0.0
6.950	0.0	0.0
6.950	0.0	0.0
6.851	0.0	0.0
6.851	0.0	0.0
6.961	0.0	0.0
6.961	0.0	0.0
6.956	0.0	0.0
6.956	0.0	0.0
6.972	0.0	0.0
6.972	0.0	0.0
6.972	0.0	0.0
6.972	0.0	0.0
6.989	0.0	0.0
6.989	0.0	0.0
4.070	14.028	3.447
4.070	14.028	3.447
6.201	13.918	2.244
6.201	13.918	2.244

Ambusher	Ambushee	Ambushee/Ambusher
4.126	14.023	3.399
4.126	14.023	3.399
6.266	13.914	2.221
6.266	13.914	2.221
6.182	13.917	2.251
6.182	13.917	2.251
6.624	13.896	2.098
6.624	13.896	2.098
6.345	13.907	2.192
6.345	13.907	2.192
6.793	13.866	2.041
6.793	13.866	2.041
4.070	14.027	3.446
4.070	14.027	3.446
6.201	13.918	2.244
6.201	13.918	2.244
4.126	14.022	3.398
4.126	14.022	3.398
6.226	13.913	2.235
6.226	13.913	2.235
6.182	13.916	2.251
6.182	13.916	2.251
6.624	13.895	2.098
6.624	13.895	2.098
6.345	13.906	2.192
6.345	13.906	2.192
6.793	13.885	2.044
6.793	13.885	2.044
4.079	13.974	3.426
4.079	13.974	3.426
6.204	13.862	2.234
6.204	13.862	2.234
4.135	13.970	3.378
4.135	13.970	3.378

Ambusher	Ambushee	Ambushee/Ambusher
6.269	13.857	2.210
6.269	13.857	2.210
6.185	13.860	2.241
6.185	13.860	2.241
6.625	13.839	2.089
6.625	13.839	2.089
6.347	13.850	2.182
6.347	13.850	2.182
6.793	13.828	2.036
6.793	13.828	2.036
4.320	12.264	2.839
4.320	12.264	2.839
6.275	11.845	1.888
6.275	11.845	1.888
4.375	12.245	2.799
4.375	12.245	2.799
6.336	11.825	1.866
6.336	11.825	1.866
6.260	11.838	1.891
6.260	11.838	1.891
6.658	11.761	1.766
6.658	11.761	1.766
6.411	11.798	1.840
6.411	11.798	1.840
6.813	11.720	1.720
6.813	11.720	1.720
4.296	12.256	2.853
4.296	12.256	2.853
6.270	11.740	1.872
6.270	11.740	1.872
4.351	12.234	2.812
4.351	12.234	2.812
6.331	11.716	1.851
6.331	11.716	1.851

Ambusher	Ambushee	Ambushee/Ambusher
6.255	11.733	1.876
6.255	11.733	1.876
6.656	11.636	1.748
6.656	11.636	1.748
6.407	11.684	1.824
6.407	11.684	1.824
6.812	11.586	1.701
6.812	11.586	1.701
4.296	12.252	2.852
4.296	12.252	2.852
6.270	11.736	1.872
6.270	11.736	1.872
4.352	12.230	2.810
4.352	12.230	2.810
6.331	11.712	1.850
6.331	11.712	1.850
6.255	11.728	1.875
6.255	11.728	1.875
6.656	11.631	1.747
6.656	11.631	1.747
6.407	11.680	1.823
6.407	11.680	1.823
6.812	11.582	1.700
6.812	11.582	1.700
4.343	11.980	2.758
4.343	11.980	2.758
6.283	11.453	1.823
6.283	11.453	1.823
4.399	11.957	2.718
4.399	11.957	2.718
6.344	11.429	1.802
6.344	11.429	1.802
6.269	11.445	1.826
6.269	11.445	1.826

Ambusher	Ambushee	Ambushee/Ambusher
6.662	11.347	1.703
6.662	11.347	1.703
6.419	11.395	1.775
6.419	11.395	1.775
6.816	11.296	1.657
6.816	11.296	1.657
5.611	2.506	0.447
5.611	2.506	0.447
6.644	1.106	0.166
6.644	1.106	0.166
5.658	2.426	0.429
5.658	2.426	0.429
6.686	1.027	0.154
6.686	1.027	0.154
6.654	1.070	0.161
6.654	1.070	0.161
6.829	0.831	0.122
6.329	0.831	0.122
6.742	0.924	0.137
6.742	0.924	0.137
6.915	0.685	0.099
6.915	0.685	0.099
4.028	14.352	3.563
4.028	14.352	3.563
6.189	14.325	2.315
6.189	14.325	2.315
4.084	14.351	3.514
4.084	14.351	3.514
6.254	14.324	2.290
6.254	14.324	2.290
6.169	14.324	2.322
6.169	14.324	2.322
6.618	14.319	2.164
6.618	14.319	2.164

Ambusher	Ambushee	Ambushee/Ambusher
6.333	14.322	2.261
6.333	14.322	2.261
6.789	14.317	2.109
6.789	14.317	2.109
4.028	14.352	3.563
4.028	14.352	3.563
6.189	14.325	2.315
6.189	14.325	2.315
4.084	14.351	3.514
4.084	14.351	3.514
6.254	14.323	2.290
6.254	14.323	2.290
6.169	14.324	2.322
6.169	14.324	2.322
6.618	14.319	2.164
6.618	14.319	2.164
6.333	14.322	2.261
6.333	14.322	2.261
6.789	14.316	2.109
6.789	14.316	2.109
4.030	14.339	3.558
4.030	14.339	3.558
6.189	14.311	2.312
6.189	14.311	2.312
4.087	14.388	3.520
4.087	14.388	3.520
6.255	14.309	2.288
6.255	14.309	2.288
6.169	14.310	2.320
6.169	14.310	2.320
6.618	14.305	2.162
6.618	14.305	2.162
6.334	14.308	2.259
6.334	14.308	2.259

Ambusher	Ambushee	Ambushee/Ambusher
6.789	14.302	2.107
6.789	14.302	2.107
4.090	13.920	3.403
4.090	13.920	3.403
6.207	13.809	2.225
6.207	13.809	2.225
4.146	13.915	3.356
4.146	13.915	3.356
6.272	13.804	2.201
6.272	13.804	2.201
6.188	13.807	2.231
6.188	13.807	2.231
6.627	13.786	2.080
6.627	13.786	2.080
6.350	13.797	2.173
6.350	13.797	2.173
6.794	13.776	2.028
6.794	13.776	2.028

APPENDIX D: FORCE STATUS AT 2.5 MIN OF ENGAGEMENT

Ambusher	Ambushee	Ambushee/Ambusher
4.904	3.223	0.657
4.904	3.223	0.657
6.492	0.756	0.116
6.492	0.756	0.116
4.946	3.110	0.629
4.946	3.110	0.629
6.544	0.646	0.099
6.544	0.646	0.099
6.488	0.725	0.112
6.488	0.725	0.112
6.762	0.288	0.043
6.762	0.288	0.043
6.607	0.499	0.076
6.607	0.499	0.076
6.877	0.064	0.009
6.877	0.064	0.009
4.907	3.203	0.653
4.907	3.203	0.653
6.493	0.734	0.113
6.493	0.734	0.113
4.967	3.090	0.622
4.967	3.090	0.622
6.545	0.623	0.095
6.545	0.623	0.095
6.489	0.702	0.108
6.489	0.702	0.108
6.763	0.266	0.039
6.763	0.266	0.039
6.608	0.477	0.072
6.608	0.477	0.072
6.877	0.042	0.006
6.877	0.042	0.006
5.195	1.817	0.350
5.195	1.817	0.350

Ambusher	Ambushee	Ambushee/Ambusher
2.000	0.0	0.0
2.000	0.0	0.0
5.252	1.704	0.324
5.252	1.704	0.324
6.615	0.0	0.0
6.615	0.0	0.0
6.897	0.0	0.0
6.897	0.0	0.0
6.677	0.0	0.0
6.677	0.0	0.0
6.797	0.0	0.0
6.797	0.0	0.0
6.572	0.0	0.0
6.572	0.0	0.0
6.839	0.0	0.0
6.839	0.0	0.0
6.950	0.0	0.0
6.950	0.0	0.0
6.851	0.0	0.0
6.851	0.0	0.0
6.961	0.0	0.0
6.961	0.0	0.0
6.956	0.0	0.0
6.956	0.0	0.0
6.972	0.0	0.0
6.972	0.0	0.0
6.972	0.0	0.0
6.972	0.0	0.0
6.989	0.0	0.0
6.989	0.0	0.0
3.127	13.981	4.471
3.127	13.981	4.471
5.963	13.799	2.314
5.963	13.799	2.314

Ambusher	Ambushee	Ambushee/Ambusher
3.185	13.975	4.388
3.185	13.975	4.388
6.032	13.792	2.286
6.032	13.792	2.286
5.885	13.799	2.345
5.885	13.799	2.345
6.514	13.763	2.113
6.514	13.763	2.113
6.079	13.784	2.267
6.079	13.784	2.267
6.717	13.747	2.047
6.717	13.747	2.047
3.127	13.980	4.471
3.127	13.980	4.471
5.963	13.798	2.314
5.963	13.798	2.314
3.186	13.974	4.386
3.186	13.974	4.386
6.032	13.791	2.286
6.032	13.791	2.286
5.885	13.798	2.345
5.885	13.798	2.345
6.514	13.762	2.113
6.514	13.762	2.113
6.079	13.783	2.267
6.079	13.783	2.267
6.717	13.746	2.046
6.717	13.746	2.046
3.140	13.927	4.435
3.140	13.927	4.435
6.966	13.742	1.973
6.966	13.742	1.973
3.198	13.921	4.353
3.198	13.921	4.353

Ambusher	Ambushee	Ambushee/Ambusher
6.036	13.735	2.276
6.036	13.735	2.276
5.889	13.742	2.334
5.889	13.742	2.334
6.516	13.705	2.103
6.516	13.705	2.103
6.082	13.726	2.257
6.082	13.726	2.257
6.718	13.688	2.038
6.718	13.688	2.038
3.500	12.084	3.453
3.500	12.084	3.453
6.074	11.454	1.886
6.074	11.454	1.886
3.559	12.060	3.389
3.559	12.060	3.389
6.140	11.428	1.861
6.140	11.428	1.861
6.010	11.451	1.905
6.010	11.451	1.905
6.566	11.329	1.725
6.566	11.329	1.725
6.188	11.395	1.841
6.188	11.395	1.841
6.750	11.272	1.670
6.750	11.272	1.670
3.480	11.980	3.443
3.480	11.980	3.443
6.072	11.130	1.833
6.072	11.130	1.833
3.539	11.949	3.376
3.539	11.949	3.376
6.139	11.089	1.806
6.139	11.089	1.806

Ambusher	Ambushee	Ambushee/Ambusher
6.009	11.129	1.852
6.009	11.129	1.852
6.566	10.962	1.670
6.566	10.962	1.670
6.188	11.056	1.787
6.188	11.056	1.787
6.750	10.888	1.613
6.750	10.888	1.613
3.481	11.976	3.440
3.481	11.976	3.440
6.073	11.125	1.832
6.073	11.125	1.832
3.540	11.945	3.374
3.540	11.945	3.374
6.139	11.092	1.807
6.139	11.092	1.807
6.010	11.123	1.851
6.010	11.123	1.851
6.566	10.957	1.669
6.566	10.957	1.669
6.188	11.050	1.786
6.188	11.050	1.786
6.750	10.882	1.612
6.750	10.882	1.612
3.456	11.695	3.384
3.456	11.695	3.384
6.091	10.839	1.780
6.091	10.839	1.780
3.605	11.663	3.235
3.605	11.663	3.235
6.156	10.805	1.755
6.156	10.805	1.755
6.029	10.837	1.797
6.029	10.837	1.797

Ambusher	Ambushee	Ambushee/Ambusher
6.574	10.670	1.623
6.574	10.670	1.623
6.205	10.762	1.734
6.205	10.762	1.734
6.756	11.296	1.672
6.756	11.296	1.672
5.500	0.846	0.154
5.500	0.846	0.154
6.644	0.0	0.0
6.644	0.0	0.0
5.553	0.743	0.134
5.553	0.743	0.134
6.688	0.0	0.0
6.688	0.0	0.0
6.655	0.0	0.0
6.655	0.0	0.0
6.832	0.0	0.0
6.832	0.0	0.0
6.746	0.0	0.0
6.746	0.0	0.0
6.918	0.0	0.0
6.918	0.0	0.0
3.062	14.341	4.684
3.062	14.341	4.684
5.942	14.295	2.406
5.942	14.295	2.406
3.120	14.339	4.596
3.120	14.339	4.596
6.012	14.293	2.377
6.012	14.293	2.377
5.862	14.295	2.439
5.862	14.295	2.439
6.505	14.286	2.196
6.505	14.286	2.196

Ambusher	Ambushee	Ambushee/Ambusher
6.085	14.291	2.349
6.085	14.291	2.349
6.711	14.282	2.128
6.711	14.282	2.128
3.062	14.341	4.684
3.062	14.341	4.684
5.942	14.295	2.406
5.942	14.295	2.406
3.120	14.339	4.596
3.120	14.339	4.596
6.012	14.293	2.377
6.012	14.293	2.377
5.862	14.295	2.439
5.862	14.295	2.439
6.505	14.286	2.196
6.505	14.286	2.196
6.058	14.291	2.359
6.058	14.291	2.359
6.711	14.282	2.128
6.711	14.282	2.128
3.065	14.328	4.675
3.065	14.328	4.675
5.943	14.281	2.403
5.943	14.281	2.403
3.123	14.326	4.587
3.123	14.326	4.587
6.013	14.279	2.375
6.013	14.279	2.375
5.863	14.281	2.436
5.863	14.281	2.436
6.505	14.271	2.194
6.505	14.271	2.194
6.059	14.277	2.356
6.059	14.277	2.356

Ambusher	Ambushee	Ambushee/Ambusher
6.711	14.267	2.126
6.711	14.267	2.126
3.154	13.882	4.401
3.154	13.822	4.382
5.970	13.713	2.297
5.970	13.713	2.297
3.212	13.875	4.320
3.212	13.875	4.320
6.039	13.706	2.270
6.039	13.706	2.270
5.893	13.713	2.327
5.893	13.713	2.327
6.518	13.679	2.099
6.518	13.679	2.099
6.085	13.698	2.251
6.085	13.698	2.251
6.719	13.664	2.034
6.719	13.664	2.034

APPENDIX E: FORCE STATUS AT 3.0 MIN OF ENGAGEMENT.

Ambusher	Ambushee	Ambushee/Ambusher
4.691	1.596	0.340
4.713	1.588	0.337
5.842	0.0	0.0
6.173	0.0	0.0
4.747	1.449	0.305
4.775	1.439	0.301
5.865	0.0	0.0
6.213	0.0	0.0
5.834	0.0	0.0
6.170	0.0	0.0
5.977	0.0	0.0
6.380	0.0	0.0
5,893	0.0	0.0
6.263	0.0	0.0
6.026	0.0	0.0
6.463	0.0	0.0
4.693	1.572	0.335
5.837	1.564	0.268
4.149	0.0	0.0
5.860	0.0	0.0
6.211	1.424	0.229
4.779	1.414	0.296
6.172	0.0	0.0
4.717	0.0	0.0
5.829	0.0	0.0
6.169	0.0	0.0
5.971	0.0	0.0
6.377	0.0	0.0
5.888	0.0	0.0
6.261	0.0	0.0
6.019	0.0	0.0
6.460	0.0	0.0
4.842	0.046	0.010
4.984	0.009	0.002

Ambusher	Ambushee	Ambushee/Ambusher
6.703	0.0	0.0
6.703	0.0	0.0
4.875	0.0	0.0
5.034	0.0	0.0
6.615	0.0	0.0
6.615	0.0	0.0
6.897	0.0	0.0
6.897	0.0	0.0
6.677	0.0	0.0
6.677	0.0	0.0
6.797	0.0	0.0
6.797	0.0	0.0
6.572	0.0	0.0
6.572	0.0	0.0
6.839	0.0	0.0
6.839	0.0	0.0
6.950	0.0	0.0
6.950	0.0	0.0
6.851	0.0	0.0
6.851	0.0	0.0
6.961	0.0	0.0
6.961	0.0	0.0
6.956	0.0	0.0
6.956	0.0	0.0
6.972	0.0	0.0
6.972	0.0	0.0
6.972	0.0	0.0
6.972	0.0	0.0
6.989	0.0	0.0
6.989	0.0	0.0
2.000	16.863	8.431
2.000	14.786	7.393
2.000	13.808	6.904
2.000	13.713	6.856

Ambusher	Ambushee	Ambushee/Ambusher
2.000	16.096	8.048
2.000	14.605	7.302
2.000	13.778	6.889
2.000	13.702	6.851
2.000	13.866	6.933
2.000	13.721	6.860
2.000	13.674	6.837
2.000	13.647	6.823
2.000	13.765	6.882
2.000	13.693	6.846
2.000	13.642	6.821
5.433	13.623	2.507
2.000	16.863	8.431
2.000	14.786	7.393
2.000	13.806	6.903
2.000	13.712	6.856
2.000	16.090	8.045
2.000	14.605	7.302
2.000	13.777	6.888
2.000	13.701	6.850
2.000	13.865	6.932
2.000	13.720	6.860
2.000	13.672	6.836
2.000	13.646	6.823
2.000	13.673	6.836
2.000	13.691	6.845
2.000	13.641	6.820
2.000	13.570	6.785
2.000	16.529	8.264
2.000	14.674	7.337
2.000	13.744	6.872
2.000	13.655	6.827
2.000	15.859	7.929
2.000	14.509	7.254

Ambusher	Ambushee	Ambushee/Ambusher
2.000	13.716	6.858
2.000	13.644	6.822
2.000	13.797	6.898
2.000	13.663	6.831
2.000	13.614	6.807
4.849	13.589	2.802
2.000	13.702	6.851
2.000	13.634	6.817
2.000	13.583	6.791
5.460	13.564	2.484
2.000	12.964	6.482
2.000	12.419	6.209
2.000	11.196	5.598
4.743	11.149	2.351
2.000	12.806	6.403
2.000	12.339	6.169
2.000	11.158	5.579
4.926	11.115	2.256
2.000	11.212	5.606
4.395	11.157	2.539
4.791	10.989	2.294
5.901	10.996	1.863
2.000	11.119	5.559
4.963	11.078	2.232
5.475	10.908	1.992
6.219	10.889	1.751
2.000	13.507	6.753
2.000	12.566	6.283
2.000	10.664	5.332
4.962	10.595	2.135
2.000	13.237	6.618
2.000	12.435	6.217
2.000	10.610	5.305
5.121	10.549	2.060

Ambusher	Ambushee	Ambushee/Ambusher
2.000	10.691	5.345
5.162	10.495	2.033
4.682	10.612	2.267
5.232	10.362	1.981
6.009	10.329	1.719
2.000	10.560	5.280
5.159	10.502	2.036
5.767	10.247	1.777
6.311	10.221	1.620
2.000	13.550	6.775
2.000	12.561	6.280
2.000	10.657	5.328
4.965	10.589	2.133
2.000	13.230	6.615
2.000	12.430	6.215
2.000	10.604	5.302
5.124	10.543	2.058
2.000	10.685	5.342
4.686	10.606	2.263
5.237	10.356	1.977
6.010	10.323	1.718
2.000	10.553	5.276
5.770	10.241	1.775
6.312	10.214	1.618
2.000	12.843	6.421
2.000	12.128	6.064
2.000	10.353	5.176
5.118	10.295	2.012
2.000	12.637	6.318
2.000	12.022	6.011
2.851	10.300	3.613
5.259	10.248	1.949
2.000	10.376	5.188
4.876	10.310	2.114

Ambusher	Ambushee	Ambushee/Ambusher
5.441	10.060	1.849
6.075	10.031	1.651
3.232	10.249	3.171
5.273	10.200	1.934
5.095	9.946	1.952
6.362	9.923	1.560
5.001	0.0	0.0
5.245	0.0	0.0
6.644	0.0	0.0
6.644	0.0	0.0
5.030	0.0	0.0
5.291	0.0	0.0
6.688	0.0	0.0
6.688	0.0	0.0
6.655	0.0	0.0
6.655	0.0	0.0
6.832	0.0	0.0
6.832	0.0	0.0
6.746	0.0	0.0
6.746	0.0	0.0
6.918	0.0	0.0
6.918	0.0	0.0
2.000	15.769	7.884
2.000	14.660	7.330
2.000	14.316	7.158
2.000	14.275	7.137
2.000	15.300	7.650
2.000	14.580	7.290
2.000	14.304	7.152
2.000	14.272	7.136
2.000	14.353	7.176
2.000	14.278	7.139
2.000	14.266	7.133
4.286	14.258	3.327

Ambusher	Ambushee	Ambushee/Ambusher
2.000	14.299	7.149
2.000	14.270	7.135
2.000	14.258	7.129
5.129	14.251	2.779
2.000	15.771	7.885
2.000	14.660	7.330
2.000	14.316	7.158
2.000	14.275	7.137
2.000	15.301	7.650
2.000	14.580	7.290
2.000	14.303	7.151
2.000	14.272	7.136
2.000	14.353	7.176
2.000	14.277	7.138
2.000	14.266	7.133
4.286	14.257	3.326
2.000	14.299	7.149
2.000	14.270	7.135
2.000	14.257	7.128
5.129	14.251	2.779
2.000	15.709	7.854
2.000	14.640	7.320
2.000	14.301	7.150
2.000	14.261	7.130
2.000	15.261	7.630
2.000	14.562	7.281
2.000	14.289	7.144
2.000	14.258	7.129
2.000	14.337	7.168
2.000	14.263	7.131
2.000	14.252	7.126
4.303	14.243	3.310
2.000	14.284	7.142
2.000	14.255	7.127

Ambusher	Ambushee	Ambushee/Ambusher
2.000	14.243	7.121
5.138	14.237	2.771
2.000	15.580	7.790
2.000	14.381	7.190
2.000	13.710	6.855
2.000	13.650	6.825
2.000	15.156	7.578
2.000	14.272	7.136
2.000	13.689	6.844
2.000	13.640	6.820
2.000	13.745	6.872
2.000	13.655	6.827
2.000	13.613	6.806
4.859	13.595	2.798
2.000	13.677	6.838
2.000	13.631	6.815
2.000	13.587	6.793
5.464	13.574	2.484

APPENDIX F: NUMERICAL RESULTS OF THE FACTORIAL ANALYSIS FOR AMBUSHER FORCE AT 2.0 MIN.

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES
1	1	3.27464	3.27464
2	1	12.26794	12.26794
3	1	2.08260	2.08260
4	1	1.42653	1.42653
5	1	74.08548	74.08548
6	1	0.48425	0.48425
7	1	68.64194	68.64194
8	1	0.00000	0.00000
12	1	2.28993	2.28992
13	1	0.06750	0.06750
14	1	0.00863	0.00863
15	1	0.98672	0.98672
16	1	0.02044	0.02044
17	1	1.15137	1.15137
18	1	0.00010	0.00010
23	1	1.34848	1.34848
24	1	0.90450	0.90450
25	1	3.58465	3.58465
26	1	0.03808	0.03808
27	1	3.83403	3.83403
28	1	0.00044	0.00044
34	1	1.44572	1.44572
35	1	0.67150	0.67150
36	1	0.01469	0.01469
37	1	0.76066	0.76066
38	1	0.00001	0.00001
45	1	0.43926	0.43926
46	1	0.00004	0.00004
47	1	0.34410	0.34410
48	1	0.00001	0.00001
56	1	0.09323	0.09323
57	1	32.33323	32.33322
58	1	0.00045	0.00045
67	1	0.00050	0.00050
68	1	-0.00000	-0.00000
78	1	0.00052	0.00052
123	1	0.00720	0.00720
124	1	0.00219	0.00219
125	1	0.71061	0.71061
126	1	0.01461	0.01461
127	1	0.81229	0.81229
128	1	-0.00035	-0.00035
134	1	0.01010	0.01010
135	1	0.03416	0.03416
136	1	0.00616	0.00616
137	1	0.05513	0.05513
138	1	-0.00010	-0.00010
145	1	0.00536	0.00536
146	1	0.00213	0.00213
147	1	0.00022	0.00022
148	1	-0.00009	-0.00009
156	1	0.00530	0.00530
157	1	0.24837	0.24837
158	1	0.00030	0.00030
167	1	0.00093	0.00093
168	1	-0.00010	-0.00010
178	1	0.00030	0.00030
234	1	0.88130	0.88130
235	1	0.44163	0.44163
236	1	0.01471	0.01471
237	1	0.54429	0.54429
238	1	-0.00027	-0.00027
245	1	0.29076	0.29076
246	1	0.00034	0.00034
247	1	0.19562	0.19562
248	1	-0.00034	-0.00034

256	1	0.01496	0.01496
257	1	1.05105	1.05105
258	1	-0.00011	-0.00011
267	1	0.00027	0.00027
268	1	-0.00040	-0.00040
278	1	-0.00040	-0.00040
345	1	0.45081	0.45081
346	1	0.00022	0.00022
347	1	0.33023	0.33023
348	1	-0.00001	-0.00001
356	1	0.00541	0.00541
357	1	0.14711	0.14711
358	1	0.00021	0.00021
367	1	0.00033	0.00033
368	1	-0.00001	-0.00001
378	1	0.00010	0.00010
456	1	0.00032	0.00032
457	1	0.31573	0.31573
458	1	0.00023	0.00023
467	1	0.00023	0.00023
468	1	-0.00000	-0.00000
478	1	0.00005	0.00005
567	1	0.00021	0.00021
568	1	0.00033	0.00033
578	1	-0.00015	-0.00015
678	1	0.00023	0.00023
1234	1	0.00398	0.00398
1235	1	0.00753	0.00753
1236	1	0.00687	0.00687
1237	1	0.02497	0.02497
1238	1	0.00030	0.00030
1245	1	0.00006	0.00006
1246	1	0.00415	0.00415
1247	1	0.00971	0.00971
1248	1	0.00035	0.00035
1256	1	0.00560	0.00560
1257	1	0.15363	0.15363
1258	1	-0.00005	-0.00005
1267	1	0.00022	0.00022
1268	1	0.00037	0.00037
1278	1	0.00010	0.00010
1345	1	0.00614	0.00614
1346	1	0.00335	0.00335
1347	1	-0.00000	-0.00000
1348	1	0.00008	0.00008
1356	1	0.00129	0.00129
1357	1	-0.00065	-0.00065
1358	1	-0.00067	-0.00067
1367	1	-0.00044	-0.00044
1368	1	0.00010	0.00010
1378	1	-0.00049	-0.00049
1456	1	0.00106	0.00106
1457	1	0.03967	0.03967
1458	1	-0.00061	-0.00061
1467	1	-0.00039	-0.00039
1468	1	0.00009	0.00009
1478	1	-0.00048	-0.00048
1567	1	-0.00024	-0.00024
1568	1	-0.00064	-0.00064
1578	1	-0.00079	-0.00079
1678	1	-0.00070	-0.00070
2345	1	0.27911	0.27911
2346	1	0.00041	0.00041
2347	1	0.20362	0.20362
2348	1	0.00028	0.00028
2356	1	0.00284	0.00284
2357	1	0.09484	0.09484
2358	1	-0.00021	-0.00021
2367	1	0.00042	0.00042
2368	1	0.00027	0.00027
2378	1	0.00012	0.00012
2456	1	0.00000	0.00000

2457	1	0.22274	0.22274
2458	1	-0.00016	-0.00016
2467	1	0.00047	0.00047
2468	1	0.00029	0.00029
2478	1	0.00024	0.00024
2567	1	0.00008	0.00008
2568	1	-0.00019	-0.00019
2578	1	-0.00017	-0.00017
2678	1	0.00012	0.00012
3456	1	-0.00041	-0.00041
3457	1	0.30400	0.30400
3458	1	-0.00052	-0.00052
3467	1	-0.00012	-0.00012
3468	1	0.00001	0.00001
3478	1	-0.00031	-0.00031
3567	1	-0.00044	-0.00044
3568	1	-0.00064	-0.00064
3578	1	-0.00053	-0.00053
3678	1	-0.00055	-0.00055
4567	1	-0.00047	-0.00047
4568	1	-0.00064	-0.00064
4578	1	-0.00053	-0.00053
4678	1	-0.00058	-0.00058
5678	1	-0.00079	-0.00079
12345	1	-0.00004	-0.00004
12346	1	0.00253	0.00253
12347	1	0.00753	0.00753
12348	1	-0.00027	-0.00027
12356	1	0.00080	0.00080
12357	1	0.00276	0.00276
12358	1	0.00007	0.00007
12367	1	0.00015	0.00015
12368	1	-0.00024	-0.00024
12378	1	-0.00026	-0.00026
12456	1	0.00082	0.00082
12457	1	0.02067	0.02067
12458	1	-0.00003	-0.00003
12467	1	0.00035	0.00035
12468	1	-0.00024	-0.00024
12478	1	-0.00034	-0.00034
12567	1	0.00054	0.00054
12568	1	-0.00003	-0.00003
12578	1	0.00060	0.00060
12678	1	-0.00015	-0.00015
13456	1	0.00133	0.00133
13457	1	0.03719	0.03719
13458	1	0.00071	0.00071
13467	1	0.00097	0.00097
13468	1	-0.00008	-0.00008
13478	1	0.00043	0.00043
13567	1	0.00120	0.00120
13568	1	0.00076	0.00076
13578	1	0.00119	0.00119
13678	1	0.00068	0.00068
14567	1	0.00112	0.00112
14568	1	0.00069	0.00069
14578	1	0.00109	0.00109
14678	1	0.00075	0.00075
15678	1	0.00132	0.00132
23456	1	0.00034	0.00034
23457	1	0.23230	0.23230
23458	1	0.00011	0.00011
23467	1	-0.00003	-0.00003
23468	1	-0.00016	-0.00016
23478	1	-0.00035	-0.00035
23567	1	0.00088	0.00088
23568	1	0.00023	0.00023
23578	1	0.00050	0.00050
23678	1	-0.00009	-0.00009
24567	1	0.00068	0.00068
24568	1	0.00020	0.00020
24578	1	0.00040	0.00040

24678	1	-0.00010	-0.00010
25678	1	0.00048	0.00048
34567	1	0.00122	0.00122
34568	1	0.00069	0.00069
34578	1	0.00080	0.00080
34678	1	0.00062	0.00062
35678	1	0.00118	0.00118
45678	1	0.00120	0.00120
123456	1	0.00242	0.00242
123457	1	0.02289	0.02289
123458	1	0.00040	0.00040
123467	1	0.00092	0.00092
123468	1	0.00022	0.00022
123478	1	0.00090	0.00090
123567	1	0.00003	0.00003
123568	1	0.00034	0.00034
123578	1	-0.00053	-0.00053
123678	1	0.00062	0.00062
124567	1	0.00029	0.00029
124568	1	0.00039	0.00039
124578	1	-0.00036	-0.00036
124678	1	0.00053	0.00053
125678	1	-0.00042	-0.00042
134567	1	-0.00058	-0.00058
134568	1	-0.00040	-0.00040
134578	1	-0.00111	-0.00111
134678	1	-0.00033	-0.00033
135678	1	-0.00144	-0.00144
145678	1	-0.00136	-0.00136
234567	1	0.00001	0.00001
234568	1	0.00014	0.00014
234578	1	-0.00022	-0.00022
234678	1	0.00049	0.00049
235678	1	-0.00044	-0.00044
245678	1	-0.00039	-0.00039
345678	1	-0.00117	-0.00117
1234567	1	-0.00029	-0.00029
1234568	1	-0.00116	-0.00116
1234578	1	-0.00011	-0.00011
1234678	1	-0.00144	-0.00144
1235678	1	0.00006	0.00006
1245678	1	-0.00004	-0.00004
1345678	1	0.00105	0.00105
2345678	1	-0.00010	-0.00010
RESIDUAL	1	-0.00073	-0.00073
TOTAL	255	220.91077	

APPENDIX G: NUMERICAL RESULTS OF THE FACTORIAL ANALYSIS FOR AMBUSHEE FORCE AT 2.0 MIN.

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES
1	1	911.80225	911.80225
2	1	4162.05859	4162.05859
3	1	340.85898	340.85889
4	1	221.34677	221.34677
5	1	6.06759	6.06759
6	1	0.00207	0.00207
7	1	7.35351	7.35351
8	1	0.00000	0.00000
12	1	571.58079	571.58057
13	1	17.01483	17.01483
14	1	42.95655	42.95654
15	1	0.22345	0.22345
16	1	0.09204	0.09204
17	1	0.72125	0.72125
18	1	0.02026	0.02026
23	1	176.66565	176.66565
24	1	99.19940	99.19940
25	1	3.51892	3.51892
26	1	0.12012	0.12012
27	1	4.65955	4.65955
28	1	0.10742	0.10742
34	1	220.14045	220.14044
35	1	0.16414	0.16414
36	1	0.14783	0.14783
37	1	0.00536	0.00536
38	1	0.00354	0.00354
45	1	0.03667	0.03667
46	1	0.13011	0.13011
47	1	0.05938	0.05938
48	1	0.00011	0.00011
56	1	0.09031	0.09031
57	1	4.75128	4.75128
58	1	0.00000	0.00000
67	1	0.06400	0.06400
68	1	-0.00000	-0.00000
78	1	0.00001	0.00001
123	1	52.58459	52.58459
124	1	90.07221	90.07220
125	1	-0.08933	-0.08933
126	1	0.00660	0.00660
127	1	0.16588	0.16588
128	1	-0.10080	-0.10080
134	1	43.21133	43.21132
135	1	1.05182	1.05182
136	1	0.18345	0.18345
137	1	0.27294	0.27294
138	1	-0.01977	-0.01977
145	1	0.14310	0.14310
146	1	0.05148	0.05148
147	1	0.59964	0.59964
148	1	-0.01974	-0.01974
156	1	0.02534	0.02534
157	1	0.74526	0.74526
158	1	-0.01959	-0.01959
167	1	0.05244	0.05244
168	1	-0.01917	-0.01917
178	1	-0.01974	-0.01974
234	1	98.12744	98.12744
235	1	0.37464	0.37464
236	1	0.09570	0.09570
237	1	-0.01721	-0.01721
238	1	-0.05762	-0.05762
245	1	-0.08203	-0.08203
246	1	0.02124	0.02124
247	1	0.12512	0.12512
248	1	-0.08521	-0.08521

256	1	-0.02808	-0.02808
257	1	3.10559	3.10559
258	1	-0.09717	-0.09717
267	1	-0.02051	-0.02051
268	1	-0.09302	-0.09302
278	1	-0.09717	-0.09717
345	1	0.03464	0.03464
346	1	0.13013	0.13013
347	1	0.05439	0.05439
348	1	-0.00345	-0.00345
356	1	0.03107	0.03107
357	1	0.10693	0.10693
358	1	-0.00337	-0.00337
367	1	0.06476	0.06476
368	1	-0.00319	-0.00319
378	1	-0.00337	-0.00337
456	1	0.03965	0.03965
457	1	0.20870	0.20870
458	1	-0.00017	-0.00017
467	1	0.06487	0.06487
468	1	-0.00038	-0.00038
478	1	-0.00015	-0.00015
567	1	0.07977	0.07977
568	1	-0.00004	-0.00004
578	1	-0.00007	-0.00007
678	1	-0.00001	-0.00001
1234	1	90.79974	90.79974
1235	1	1.41620	1.41620
1236	1	0.29384	0.29384
1237	1	0.50008	0.50008
1238	1	0.06500	0.06500
1245	1	0.39124	0.39124
1246	1	0.15929	0.15929
1247	1	0.94440	0.94440
1248	1	0.08862	0.08862
1256	1	0.14221	0.14221
1257	1	0.54111	0.54111
1258	1	0.09891	0.09891
1267	1	0.16889	0.16889
1268	1	0.09636	0.09636
1278	1	0.09953	0.09953
1345	1	0.18054	0.18054
1346	1	0.09476	0.09476
1347	1	0.63319	0.63319
1348	1	0.02131	0.02131
1356	1	0.04275	0.04275
1357	1	0.02848	0.02848
1358	1	0.02042	0.02042
1367	1	0.09435	0.09435
1368	1	0.02021	0.02021
1378	1	0.02047	0.02047
1456	1	0.06397	0.06397
1457	1	0.73189	0.73189
1458	1	0.02034	0.02034
1467	1	0.09235	0.09235
1468	1	0.02048	0.02048
1478	1	0.02056	0.02056
1567	1	0.10788	0.10788
1568	1	0.02075	0.02075
1578	1	0.02069	0.02069
1678	1	0.02069	0.02069
2345	1	0.06277	0.06277
2346	1	0.16142	0.16142
2347	1	0.27321	0.27321
2348	1	0.05646	0.05646
2356	1	0.09268	0.09268
2357	1	0.08212	0.08212
2358	1	0.05890	0.05890
2367	1	0.13358	0.13358
2368	1	0.05710	0.05710
2378	1	0.05676	0.05676
2456	1	0.11969	0.11969

2457	1	0.44839	0.44839
2458	1	0.08246	0.08246
2467	1	0.15814	0.15814
2468	1	0.08380	0.08380
2478	1	0.08209	0.08209
2567	1	0.18036	0.18036
2568	1	0.09781	0.09781
2578	1	0.09396	0.09396
2678	1	0.09732	0.09732
3456	1	0.04131	0.04131
3457	1	0.21764	0.21764
3458	1	0.00401	0.00401
3467	1	0.07093	0.07093
3468	1	0.00427	0.00427
3478	1	0.00387	0.00387
3567	1	0.08059	0.08059
3568	1	0.00357	0.00357
3578	1	0.00338	0.00338
3678	1	0.00361	0.00361
4567	1	0.07986	0.07986
4568	1	0.00039	0.00039
4578	1	0.00018	0.00018
4678	1	0.00026	0.00026
5678	1	0.00019	0.00019
12345	1	0.26090	0.26090
12346	1	0.01831	0.01831
12347	1	0.82459	0.82459
12348	1	-0.04346	-0.04346
12356	1	-0.02570	-0.02570
12357	1	-0.02115	-0.02115
12358	1	-0.04990	-0.04990
12367	1	0.00772	0.00772
12368	1	-0.04834	-0.04834
12378	1	-0.04818	-0.04818
12456	1	-0.02422	-0.02422
12457	1	0.84219	0.84219
12458	1	-0.07106	-0.07106
12467	1	-0.00360	-0.00360
12468	1	-0.06882	-0.06882
12478	1	-0.06869	-0.06869
12567	1	-0.01022	-0.01022
12568	1	-0.08562	-0.08562
12578	1	-0.08165	-0.08165
12678	1	-0.08144	-0.08144
13456	1	0.02024	0.02024
13457	1	0.70008	0.70008
13458	1	-0.02113	-0.02113
13467	1	0.05360	0.05360
13468	1	-0.02174	-0.02174
13478	1	-0.02145	-0.02145
13567	1	0.06284	0.06284
13568	1	-0.02126	-0.02126
13578	1	-0.02080	-0.02080
13678	1	-0.02071	-0.02071
14567	1	0.06653	0.06653
14568	1	-0.02061	-0.02061
14578	1	-0.02030	-0.02030
14678	1	-0.02055	-0.02055
15678	1	-0.02075	-0.02075
23456	1	-0.00748	-0.00748
23457	1	0.32551	0.32551
23458	1	-0.04800	-0.04800
23467	1	0.02769	0.02769
23468	1	-0.04285	-0.04285
23478	1	-0.03713	-0.03713
23567	1	0.03893	0.03893
23568	1	-0.04472	-0.04472
23578	1	-0.04369	-0.04369
23678	1	-0.03790	-0.03790
24567	1	0.01872	0.01872
24568	1	-0.06885	-0.06885
24578	1	-0.06424	-0.06424

24678	1	-0.06488	-0.06488
25678	1	-0.08179	-0.08179
34567	1	0.07406	0.07406
34568	1	-0.00313	-0.00313
34578	1	-0.00245	-0.00245
34678	1	-0.00288	-0.00288
35678	1	-0.00074	-0.00074
45678	1	0.00037	0.00037
123456	1	0.10261	0.10261
123457	1	0.94271	0.94271
123458	1	0.05129	0.05129
123467	1	0.11187	0.11187
123468	1	0.04143	0.04143
123478	1	0.03987	0.03987
123567	1	0.14125	0.14125
123568	1	0.05072	0.05072
123578	1	0.05028	0.05028
123678	1	0.04860	0.04860
124567	1	0.14425	0.14425
124568	1	0.06976	0.06976
124578	1	0.06510	0.06510
124678	1	0.06040	0.06040
125678	1	0.07642	0.07642
134567	1	0.10859	0.10859
134568	1	0.02498	0.02498
134578	1	0.02411	0.02411
134678	1	0.02483	0.02483
135678	1	0.02222	0.02222
145678	1	0.02283	0.02283
234567	1	0.13048	0.13048
234568	1	0.04107	0.04107
234578	1	0.04239	0.04239
234678	1	0.02914	0.02914
235678	1	0.04382	0.04382
245678	1	0.05885	0.05885
345678	1	0.00118	0.00118
1234567	1	0.04020	0.04020
1234568	1	-0.03672	-0.03672
1234578	1	-0.03738	-0.03738
1234678	1	-0.02363	-0.02363
1235678	1	-0.03952	-0.03952
1245678	1	-0.04390	-0.04390
1345678	1	-0.03435	-0.03435
2345678	1	-0.02842	-0.02842
RESIDUAL	1	-0.28906	-0.28906
TOTAL	255	7187.44922	

APPENDIX H: NUMERICAL RESULTS OF THE FACTORIAL ANALYSIS FOR AMBUSHEE-AMBUSHER FORCE RATIO AT 2.0 MIN.

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES
1	1	29.58610	29.58609
2	1	138.73056	138.73056
3	1	10.79091	10.79091
4	1	7.01829	7.01829
5	1	15.38373	15.38373
6	1	0.05634	0.05634
7	1	15.17265	15.17265
8	1	0.00000	0.00000
12	1	17.32849	17.32848
13	1	0.57544	0.57544
14	1	1.29613	1.29613
15	1	0.47355	0.47355
16	1	0.00839	0.00839
17	1	0.38406	0.38406
18	1	0.00016	0.00016
23	1	4.93345	4.93345
24	1	2.74040	2.74040
25	1	2.07073	2.07073
26	1	0.01754	0.01754
27	1	1.91682	1.91682
28	1	0.00038	0.00038
34	1	7.01333	7.01333
35	1	0.24155	0.24155
36	1	0.00749	0.00749
37	1	0.18491	0.18491
38	1	0.00011	0.00011
45	1	0.11237	0.11237
46	1	0.00090	0.00090
47	1	0.15111	0.15111
48	1	0.00015	0.00015
56	1	0.00832	0.00832
57	1	9.42189	9.42189
58	1	0.00001	0.00001
67	1	0.00721	0.00721
68	1	0.00001	0.00001
78	1	0.00003	0.00003
123	1	1.91989	1.91989
124	1	2.98993	2.98993
125	1	0.23085	0.23085
126	1	0.00799	0.00799
127	1	0.17428	0.17428
128	1	0.00016	0.00016
134	1	1.30113	1.30113
135	1	0.00171	0.00171
136	1	0.00436	0.00436
137	1	0.00045	0.00045
138	1	0.00005	0.00005
145	1	0.00527	0.00527
146	1	0.00306	0.00306
147	1	0.00017	0.00017
148	1	0.00015	0.00015
156	1	0.00041	0.00041
157	1	0.18644	0.18644
158	1	0.00009	0.00009
167	1	0.00093	0.00093
168	1	0.00021	0.00021
178	1	0.00005	0.00005
234	1	2.69411	2.69411
235	1	0.09954	0.09954
236	1	0.00599	0.00599
237	1	0.06180	0.06180
238	1	0.00037	0.00037
245	1	0.02742	0.02742
246	1	0.00177	0.00177
247	1	0.04507	0.04507
248	1	0.00038	0.00038

256	1	0.00060	0.00060
257	1	1.06529	1.06529
258	1	0.00050	0.00050
267	1	0.00130	0.00130
268	1	0.00027	0.00027
278	1	0.00050	0.00050
345	1	0.11109	0.11109
346	1	0.00092	0.00092
347	1	0.14538	0.14538
348	1	0.00002	0.00002
356	1	0.00089	0.00089
357	1	0.08127	0.08127
358	1	0.00032	0.00032
367	1	0.00187	0.00187
368	1	0.00010	0.00010
378	1	0.00029	0.00029
456	1	0.00149	0.00149
457	1	0.12485	0.12485
458	1	0.00029	0.00029
467	1	0.00238	0.00238
468	1	-0.00002	-0.00002
478	1	0.00025	0.00025
567	1	0.00478	0.00478
568	1	0.00030	0.00030
578	1	0.00056	0.00056
678	1	0.00030	0.00030
1234	1	3.00956	3.00956
1235	1	0.00358	0.00358
1236	1	0.00284	0.00284
1237	1	0.01727	0.01727
1238	1	-0.00013	-0.00013
1245	1	0.02695	0.02695
1246	1	0.00309	0.00309
1247	1	0.01220	0.01220
1248	1	-0.00021	-0.00021
1256	1	0.00011	0.00011
1257	1	0.07254	0.07254
1258	1	-0.00030	-0.00030
1267	1	0.00118	0.00118
1268	1	-0.00011	-0.00011
1278	1	-0.00032	-0.00032
1345	1	0.00468	0.00468
1346	1	0.00261	0.00261
1347	1	0.00018	0.00018
1348	1	-0.00006	-0.00006
1356	1	0.00046	0.00046
1357	1	0.00480	0.00480
1358	1	-0.00020	-0.00020
1367	1	0.00171	0.00171
1368	1	-0.00018	-0.00018
1378	1	-0.00016	-0.00016
1456	1	0.00035	0.00035
1457	1	0.00146	0.00146
1458	1	-0.00029	-0.00029
1467	1	0.00138	0.00138
1468	1	-0.00026	-0.00026
1478	1	-0.00027	-0.00027
1567	1	0.00134	0.00134
1568	1	-0.00024	-0.00024
1578	1	-0.00032	-0.00032
1678	1	-0.00026	-0.00026
2345	1	0.02733	0.02733
2346	1	0.00087	0.00087
2347	1	0.04732	0.04732
2348	1	-0.00036	-0.00036
2356	1	0.00017	0.00017
2357	1	0.01649	0.01649
2358	1	-0.00048	-0.00048
2367	1	0.00105	0.00105
2368	1	-0.00004	-0.00004
2378	1	-0.00040	-0.00040
2456	1	0.00081	0.00081

2457	1	0.04773	0.04773
2458	1	-0.00043	-0.00043
2467	1	0.00193	0.00193
2468	1	0.00016	0.00016
2478	1	-0.00028	-0.00028
2567	1	0.00046	0.00046
2568	1	-0.00039	-0.00039
2578	1	-0.00080	-0.00080
2678	1	-0.00034	-0.00034
3456	1	0.00073	0.00073
3457	1	0.12466	0.12466
3458	1	-0.00059	-0.00059
3467	1	0.00174	0.00174
3468	1	-0.00007	-0.00007
3478	1	-0.00059	-0.00059
3567	1	0.00049	0.00049
3568	1	-0.00071	-0.00071
3578	1	-0.00106	-0.00106
3678	1	-0.00075	-0.00075
4567	1	0.00069	0.00069
4568	1	-0.00063	-0.00063
4578	1	-0.00107	-0.00107
4678	1	-0.00062	-0.00062
5678	1	-0.00104	-0.00104
12345	1	0.02775	0.02775
12346	1	0.00296	0.00296
12347	1	0.01175	0.01175
12348	1	-0.00045	-0.00045
12356	1	0.00037	0.00037
12357	1	0.02403	0.02403
12358	1	-0.00026	-0.00026
12367	1	0.00126	0.00126
12368	1	-0.00079	-0.00079
12378	1	-0.00025	-0.00025
12456	1	0.00064	0.00064
12457	1	0.00147	0.00147
12458	1	-0.00023	-0.00023
12467	1	0.00126	0.00126
12468	1	-0.00082	-0.00082
12478	1	-0.00023	-0.00023
12567	1	0.00154	0.00154
12568	1	-0.00026	-0.00026
12578	1	0.00025	0.00025
12678	1	-0.00023	-0.00023
13456	1	0.00089	0.00089
13457	1	0.00139	0.00139
13458	1	-0.00002	-0.00002
13467	1	0.00153	0.00153
13468	1	-0.00019	-0.00019
13478	1	-0.00003	-0.00003
13567	1	0.00202	0.00202
13568	1	0.00019	0.00019
13578	1	0.00039	0.00039
13678	1	0.00021	0.00021
14567	1	0.00196	0.00196
14568	1	0.00029	0.00029
14578	1	0.00044	0.00044
14678	1	0.00030	0.00030
15678	1	0.00043	0.00043
23456	1	0.00103	0.00103
23457	1	0.04779	0.04779
23458	1	0.00012	0.00012
23467	1	0.00177	0.00177
23468	1	-0.00095	-0.00095
23478	1	-0.00012	-0.00012
23567	1	0.00146	0.00146
23568	1	-0.00040	-0.00040
23578	1	0.00032	0.00032
23678	1	-0.00048	-0.00048
24567	1	0.00179	0.00179
24568	1	-0.00056	-0.00056
24578	1	0.00015	0.00015

24678	1	-0.00075	-0.00075
25678	1	0.00010	0.00010
34567	1	0.00340	0.00340
34568	1	0.00092	0.00092
34578	1	0.00148	0.00148
34678	1	0.00099	0.00099
35678	1	0.00173	0.00173
45678	1	0.00169	0.00169
123456	1	0.00179	0.00179
123457	1	0.00686	0.00686
123458	1	0.00112	0.00112
123467	1	0.00274	0.00274
123468	1	0.00234	0.00234
123478	1	0.00115	0.00115
123567	1	0.00287	0.00287
123568	1	0.00164	0.00164
123578	1	0.00055	0.00055
123678	1	0.00161	0.00161
124567	1	0.00281	0.00281
124568	1	0.00163	0.00163
124578	1	0.00064	0.00064
124678	1	0.00164	0.00164
125678	1	0.00071	0.00071
134567	1	0.00243	0.00243
134568	1	0.00051	0.00051
134578	1	0.00021	0.00021
134678	1	0.00048	0.00048
135678	1	-0.00021	-0.00021
145678	1	-0.00028	-0.00028
234567	1	0.00227	0.00227
234568	1	0.00163	0.00163
234578	1	0.00039	0.00039
234678	1	0.00185	0.00185
235678	1	0.00110	0.00110
245678	1	0.00128	0.00128
345678	1	-0.00200	-0.00200
1234567	1	0.00701	0.00701
1234568	1	-0.00308	-0.00308
1234578	1	0.00481	0.00481
1234678	1	-0.00309	-0.00309
1235678	1	-0.00197	-0.00197
1245678	1	-0.00202	-0.00202
1345678	1	-0.00076	-0.00076
2345678	1	-0.00226	-0.00226
RESIDUAL	1	0.00586	0.00586
TOTAL	255	280.52710	

APPENDIX I. NUMERICAL RESULTS OF THE FACTORIAL ANALYSIS FOR AMBUSHER FORCE AT 2.5 MIN.

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES
1	1	4.92825	4.92825
2	1	21.25375	21.25374
3	1	2.16530	2.16530
4	1	4.36065	4.36065
5	1	129.87241	129.87241
6	1	1.63007	1.63007
7	1	107.94009	107.94009
8	1	0.00000	0.00000
12	1	2.24006	2.24006
13	1	0.11116	0.11116
14	1	0.12332	0.12332
15	1	0.93267	0.93267
16	1	0.08249	0.08249
17	1	4.04547	4.04547
18	1	0.00015	0.00015
23	1	0.66382	0.66382
24	1	3.83120	3.83120
25	1	4.15938	4.15938
26	1	0.22862	0.22862
27	1	13.34873	13.34873
28	1	0.00056	0.00056
34	1	4.35347	4.35347
35	1	0.37674	0.37674
36	1	0.10926	0.10926
37	1	2.64669	2.64669
38	1	0.00001	0.00001
45	1	1.86164	1.86164
46	1	0.22176	0.22176
47	1	0.13512	0.13512
48	1	0.00014	0.00014
56	1	0.00915	0.00915
57	1	46.13269	46.13268
58	1	0.00027	0.00027
67	1	0.20427	0.20427
68	1	0.00002	0.00002
78	1	0.00034	0.00034
123	1	0.70497	0.70497
124	1	0.12982	0.12982
125	1	0.22131	0.22131
126	1	0.30946	0.30946
127	1	4.07112	4.07112
128	1	-0.00044	-0.00044
134	1	0.11415	0.11415
135	1	0.10288	0.10288
136	1	0.13850	0.13850
137	1	0.43980	0.43980
138	1	-0.00010	-0.00010
145	1	0.19915	0.19915
146	1	0.14930	0.14930
147	1	0.33704	0.33704
148	1	-0.00012	-0.00012
156	1	0.29954	0.29954
157	1	1.46111	1.46111
158	1	0.00026	0.00026
167	1	0.20582	0.20582
168	1	-0.00012	-0.00012
178	1	0.00040	0.00040
234	1	3.77322	3.77322
235	1	0.02197	0.02197
236	1	0.35930	0.35930
237	1	2.77464	2.77464
238	1	-0.00027	-0.00027
245	1	1.99586	1.99586
246	1	0.49377	0.49377
247	1	0.00638	0.00638
248	1	-0.00026	-0.00026

256	1	0.78013	0.78013
257	1	4.99308	4.99308
258	1	-0.00011	-0.00011
267	1	0.44683	0.44683
268	1	-0.00026	-0.00026
278	1	-0.00022	-0.00022
345	1	1.82564	1.82564
346	1	0.21903	0.21903
347	1	0.13510	0.13510
348	1	0.00001	0.00001
356	1	0.30966	0.30966
357	1	1.02569	1.02569
358	1	0.00058	0.00058
367	1	0.18756	0.18756
368	1	-0.00003	-0.00003
378	1	0.00031	0.00031
456	1	0.21875	0.21875
457	1	0.06819	0.06819
458	1	0.00054	0.00054
467	1	0.19081	0.19081
468	1	-0.00015	-0.00015
478	1	0.00035	0.00035
567	1	0.19441	0.19441
568	1	0.00061	0.00061
578	1	0.00049	0.00049
678	1	0.00047	0.00047
1234	1	0.13033	0.13033
1235	1	0.47497	0.47497
1236	1	0.38778	0.38778
1237	1	0.59979	0.59979
1238	1	0.00015	0.00015
1245	1	0.34210	0.34210
1246	1	0.40565	0.40565
1247	1	0.92283	0.92283
1248	1	0.00007	0.00007
1256	1	0.60678	0.60678
1257	1	1.73430	1.73430
1258	1	0.00012	0.00012
1267	1	0.48962	0.48962
1268	1	0.00015	0.00015
1278	1	0.00008	0.00008
1345	1	0.19971	0.19971
1346	1	0.15852	0.15852
1347	1	0.35051	0.35051
1348	1	-0.00004	-0.00004
1356	1	0.23464	0.23464
1357	1	0.20340	0.20340
1358	1	-0.00014	-0.00014
1367	1	0.20746	0.20746
1368	1	0.00007	0.00007
1378	1	-0.00048	-0.00048
1456	1	0.24171	0.24171
1457	1	0.09533	0.09533
1458	1	-0.00020	-0.00020
1467	1	0.20984	0.20984
1468	1	0.00008	0.00008
1478	1	-0.00059	-0.00059
1567	1	0.20626	0.20626
1568	1	-0.00015	-0.00015
1578	1	-0.00033	-0.00033
1678	1	-0.00068	-0.00068
2345	1	1.99784	1.99784
2346	1	0.50822	0.50822
2347	1	0.00833	0.00833
2348	1	0.00003	0.00003
2356	1	0.62138	0.62138
2357	1	1.28758	1.28758
2358	1	-0.00015	-0.00015
2367	1	0.45911	0.45911
2368	1	0.00002	0.00002
2378	1	0.00003	0.00003
2456	1	0.53812	0.53812

2457	1	0.01245	0.01245
2458	1	-0.00008	-0.00008
2467	1	0.47656	0.47656
2468	1	0.00002	0.00002
2478	1	-0.00015	-0.00015
2567	1	0.46267	0.46267
2568	1	-0.00008	-0.00008
2578	1	0.00023	0.00023
2678	1	-0.00015	-0.00015
3456	1	0.22894	0.22894
3457	1	0.06171	0.06171
3458	1	-0.00061	-0.00061
3467	1	0.19170	0.19170
3468	1	-0.00000	-0.00000
3478	1	-0.00036	-0.00036
3567	1	0.18290	0.18290
3568	1	-0.00056	-0.00056
3578	1	-0.00057	-0.00057
3678	1	-0.00052	-0.00052
4567	1	0.19403	0.19403
4568	1	-0.00062	-0.00062
4578	1	-0.00068	-0.00068
4678	1	-0.00063	-0.00063
5678	1	-0.00087	-0.00087
12345	1	0.32837	0.32837
12346	1	0.40334	0.40334
12347	1	0.92018	0.92018
12348	1	0.00025	0.00025
12356	1	0.53966	0.53966
12357	1	0.40100	0.40100
12358	1	-0.00057	-0.00057
12367	1	0.50926	0.50926
12368	1	0.00017	0.00017
12378	1	-0.00002	-0.00002
12456	1	0.54900	0.54900
12457	1	0.38482	0.38482
12458	1	-0.00046	-0.00046
12467	1	0.49055	0.49055
12468	1	0.00022	0.00022
12478	1	0.00012	0.00012
12567	1	0.50629	0.50629
12568	1	-0.00064	-0.00064
12578	1	0.00053	0.00053
12678	1	-0.00005	-0.00005
13456	1	0.24011	0.24011
13457	1	0.09505	0.09505
13458	1	-0.00050	-0.00050
13467	1	0.20018	0.20018
13468	1	0.00018	0.00018
13478	1	0.00032	0.00032
13567	1	0.21172	0.21172
13568	1	-0.00065	-0.00065
13578	1	0.00054	0.00054
13678	1	0.00038	0.00038
14567	1	0.20784	0.20784
14568	1	-0.00043	-0.00043
14578	1	0.00016	0.00016
14678	1	0.00047	0.00047
15678	1	0.00088	0.00088
23456	1	0.53504	0.53504
23457	1	0.01183	0.01183
23458	1	-0.00031	-0.00031
23467	1	0.46165	0.46165
23468	1	0.00027	0.00027
23478	1	0.00006	0.00006
23567	1	0.46941	0.46941
23568	1	-0.00021	-0.00021
23578	1	0.00054	0.00054
23678	1	0.00005	0.00005
24567	1	0.46746	0.46746
24568	1	-0.00018	-0.00018
24578	1	0.00056	0.00056

24678	1	0.00019	0.00019
25678	1	0.00083	0.00083
34567	1	0.18495	0.18495
34568	1	-0.00008	-0.00008
34578	1	0.00102	0.00102
34678	1	0.00011	0.00011
35678	1	0.00143	0.00143
45678	1	0.00125	0.00125
123456	1	0.56671	0.56671
123457	1	0.40059	0.40059
123458	1	0.00141	0.00141
123467	1	0.49321	0.49321
123468	1	-0.00058	-0.00058
123478	1	-0.00012	-0.00012
123567	1	0.49502	0.49502
123568	1	0.00148	0.00148
123578	1	0.00129	0.00129
123678	1	0.00015	0.00015
124567	1	0.50755	0.50755
124568	1	0.00123	0.00123
124578	1	0.00164	0.00164
124678	1	0.00015	0.00015
125678	1	0.00144	0.00144
134567	1	0.21160	0.21160
134568	1	0.00180	0.00180
134578	1	0.00190	0.00190
134678	1	0.00022	0.00022
135678	1	0.00112	0.00112
145678	1	0.00172	0.00172
234567	1	0.47220	0.47220
234568	1	0.00105	0.00105
234578	1	0.00105	0.00105
234678	1	0.00020	0.00020
235678	1	0.00104	0.00104
245678	1	0.00131	0.00131
345678	1	0.00131	0.00131
1234567	1	0.48868	0.48868
1234568	1	-0.00241	-0.00241
1234578	1	-0.00205	-0.00205
1234678	1	-0.00016	-0.00016
1235678	1	-0.00186	-0.00186
1245678	1	-0.00253	-0.00253
1345678	1	-0.00254	-0.00254
2345678	1	-0.00269	-0.00269
RESIDUAL	1	-0.00708	-0.00708
TOTAL	255	414.03198	

APPENDIX J: NUMERICAL RESULTS OF THE FACTORIAL ANALYSIS FOR AMBUSHEE FORCE AT 2.5 MIN.

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES
1	1	1204.39648	1204.39648
2	1	5338.41846	5338.41797
3	1	257.39810	257.39795
4	1	198.93869	198.93869
5	1	11.21933	11.21933
6	1	0.05377	0.05377
7	1	10.31066	10.31066
8	1	0.00002	0.00002
12	1	752.24377	752.24365
13	1	58.71691	58.71690
14	1	76.62922	76.62921
15	1	1.87280	1.87280
16	1	0.09644	0.09644
17	1	1.68860	1.68860
18	1	0.05414	0.05414
23	1	104.81439	104.81439
24	1	73.59753	73.59753
25	1	6.02441	6.02441
26	1	0.15625	0.15625
27	1	5.54492	5.54492
28	1	0.13281	0.13281
34	1	197.43480	197.43478
35	1	1.16203	1.16203
36	1	0.06447	0.06447
37	1	0.97983	0.97983
38	1	0.00653	0.00653
45	1	0.06160	0.06160
46	1	0.00620	0.00620
47	1	0.06142	0.06142
48	1	0.00081	0.00081
56	1	0.00064	0.00064
57	1	6.51576	6.51576
58	1	0.00061	0.00061
67	1	0.01240	0.01240
68	1	0.00001	0.00001
78	1	0.00062	0.00062
123	1	124.34961	124.34961
124	1	145.82800	145.82800
125	1	0.55727	0.55727
126	1	-0.05467	-0.05467
127	1	0.49011	0.49011
128	1	-0.07582	-0.07582
134	1	77.17151	77.17151
135	1	0.65854	0.65854
136	1	-0.04913	-0.04913
137	1	0.53805	0.53805
138	1	-0.05070	-0.05070
145	1	0.07802	0.07802
146	1	-0.04315	-0.04315
147	1	0.08873	0.08873
148	1	-0.04864	-0.04864
156	1	-0.03240	-0.03240
157	1	0.64790	0.64790
158	1	-0.04695	-0.04695
167	1	-0.03988	-0.03988
168	1	-0.04736	-0.04736
178	1	-0.04672	-0.04672
234	1	72.57104	72.57104
235	1	1.98718	1.98718
236	1	0.01758	0.01758
237	1	1.69824	1.69824
238	1	-0.05591	-0.05591
245	1	0.29456	0.29456
246	1	-0.05688	-0.05688
247	1	0.27637	0.27637
248	1	-0.06042	-0.06042

256	1	-0.07422	-0.07422
257	1	3.77832	3.77832
258	1	-0.07690	-0.07690
267	1	-0.06018	-0.06018
268	1	-0.07910	-0.07910
278	1	-0.07520	-0.07520
345	1	0.05450	0.05450
346	1	-0.00185	-0.00185
347	1	0.05170	0.05170
348	1	-0.00708	-0.00708
356	1	0.02176	0.02176
357	1	0.11337	0.11337
358	1	-0.00664	-0.00664
367	1	0.00527	0.00527
368	1	-0.00638	-0.00638
378	1	-0.00680	-0.00680
456	1	0.00665	0.00665
457	1	0.15048	0.15048
458	1	-0.00143	-0.00143
467	1	0.00685	0.00685
468	1	-0.00085	-0.00085
478	1	-0.00154	-0.00154
567	1	0.00306	0.00306
568	1	-0.00059	-0.00059
578	1	-0.00123	-0.00123
678	1	-0.00056	-0.00056
1234	1	146.70580	146.70580
1235	1	1.12979	1.12979
1236	1	0.01866	0.01866
1237	1	0.95044	0.95044
1238	1	0.01605	0.01605
1245	1	0.34224	0.34224
1246	1	0.03131	0.03131
1247	1	0.34108	0.34108
1248	1	0.02322	0.02322
1256	1	0.04804	0.04804
1257	1	0.25995	0.25995
1258	1	0.04260	0.04260
1267	1	0.04108	0.04108
1268	1	0.04334	0.04334
1278	1	0.03443	0.03443
1345	1	0.17183	0.17183
1346	1	0.05357	0.05357
1347	1	0.18538	0.18538
1348	1	0.04785	0.04785
1356	1	0.04674	0.04674
1357	1	0.42997	0.42997
1358	1	0.04524	0.04524
1367	1	0.05261	0.05261
1368	1	0.04600	0.04600
1378	1	0.04489	0.04489
1456	1	0.04578	0.04578
1457	1	0.13765	0.13765
1458	1	0.04355	0.04355
1467	1	0.04690	0.04690
1468	1	0.04412	0.04412
1478	1	0.04330	0.04330
1567	1	0.05119	0.05119
1568	1	0.04256	0.04256
1578	1	0.04243	0.04243
1678	1	0.04234	0.04234
2345	1	0.36673	0.36673
2346	1	0.01176	0.01176
2347	1	0.33754	0.33754
2348	1	0.00931	0.00931
2356	1	0.04665	0.04665
2357	1	0.33286	0.33286
2358	1	0.01010	0.01010
2367	1	0.02373	0.02373
2368	1	0.01373	0.01373
2378	1	0.01062	0.01062
2456	1	0.01671	0.01671

2457	1	0.38525	0.38525
2458	1	0.01309	0.01309
2467	1	0.02119	0.02119
2468	1	0.01797	0.01797
2478	1	0.01413	0.01413
2567	1	0.03023	0.03023
2568	1	0.03174	0.03174
2578	1	0.02838	0.02838
2678	1	0.03369	0.03369
3456	1	0.01588	0.01588
3457	1	0.16157	0.16157
3458	1	0.00779	0.00779
3467	1	0.01713	0.01713
3468	1	0.00756	0.00756
3478	1	0.00798	0.00798
3567	1	0.01223	0.01223
3568	1	0.00728	0.00728
3578	1	0.00797	0.00797
3678	1	0.00744	0.00744
4567	1	0.00925	0.00925
4568	1	0.00154	0.00154
4578	1	0.00211	0.00211
4678	1	0.00150	0.00150
5678	1	0.00133	0.00133
12345	1	0.35951	0.35951
12346	1	0.05068	0.05068
12347	1	0.36838	0.36838
12348	1	0.03799	0.03799
12356	1	0.04332	0.04332
12357	1	0.61665	0.61665
12358	1	0.03502	0.03502
12367	1	0.04885	0.04885
12368	1	0.03314	0.03314
12378	1	0.03880	0.03880
12456	1	0.03502	0.03502
12457	1	0.23504	0.23504
12458	1	0.03127	0.03127
12467	1	0.03412	0.03412
12468	1	0.02618	0.02618
12478	1	0.03357	0.03357
12567	1	0.02600	0.02600
12568	1	0.01204	0.01204
12578	1	0.01933	0.01933
12678	1	0.01612	0.01612
13456	1	-0.03910	-0.03910
13457	1	0.05527	0.05527
13458	1	-0.04167	-0.04167
13467	1	-0.03729	-0.03729
13468	1	-0.04250	-0.04250
13478	1	-0.04098	-0.04098
13567	1	-0.03259	-0.03259
13568	1	-0.04080	-0.04080
13578	1	-0.04010	-0.04010
13678	1	-0.04070	-0.04070
14567	1	-0.02565	-0.02565
14568	1	-0.03894	-0.03894
14578	1	-0.03654	-0.03654
14678	1	-0.03885	-0.03885
15678	1	-0.03810	-0.03810
23456	1	0.05725	0.05725
23457	1	0.42986	0.42986
23458	1	0.05579	0.05579
23467	1	0.05484	0.05484
23468	1	0.04840	0.04840
23478	1	0.05072	0.05072
23567	1	0.05782	0.05782
23568	1	0.05518	0.05518
23578	1	0.05251	0.05251
23678	1	0.05142	0.05142
24567	1	0.06270	0.06270
24568	1	0.04868	0.04868
24578	1	0.05317	0.05317

24678	1	0.04858	0.04858
25678	1	0.03329	0.03329
34567	1	-0.00073	-0.00073
34568	1	-0.00635	-0.00635
34578	1	-0.00642	-0.00642
34678	1	-0.00666	-0.00666
35678	1	-0.00588	-0.00588
45678	1	-0.00101	-0.00101
123456	1	-0.07012	-0.07012
123457	1	0.11982	0.11982
123458	1	-0.07862	-0.07862
123467	1	-0.06877	-0.06877
123468	1	-0.06707	-0.06707
123478	1	-0.07430	-0.07430
123567	1	-0.06633	-0.06633
123568	1	-0.07423	-0.07423
123578	1	-0.06796	-0.06796
123678	1	-0.07303	-0.07303
124567	1	-0.05550	-0.05550
124568	1	-0.06652	-0.06652
124578	1	-0.07608	-0.07608
124678	1	-0.06790	-0.06790
125678	1	-0.05461	-0.05461
134567	1	0.05133	0.05133
134568	1	0.04017	0.04017
134578	1	0.03849	0.03849
134678	1	0.03982	0.03982
135678	1	0.03817	0.03817
145678	1	0.03942	0.03942
234567	1	-0.09705	-0.09705
234568	1	-0.10347	-0.10347
234578	1	-0.10582	-0.10582
234678	1	-0.09762	-0.09762
235678	1	-0.11028	-0.11028
245678	1	-0.10156	-0.10156
345678	1	0.00480	0.00480
1234567	1	0.12516	0.12516
1234568	1	0.11929	0.11929
1234578	1	0.12829	0.12829
1234678	1	0.10911	0.10911
1235678	1	0.12025	0.12025
1245678	1	0.11206	0.11206
1345678	1	-0.04635	-0.04635
2345678	1	0.16643	0.16643
RESIDUAL	1	-0.51172	-0.51172
TOTAL	255	8894.05469	

AMBUSHEE-AMBUSHER FORCE RATIO AT 2.5 MIN.

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES
1	1	48.44675	48.44675
2	1	231.72009	231.72009
3	1	10.73165	10.73165
4	1	7.07181	7.07181
5	1	40.37685	40.37685
6	1	0.21861	0.21861
7	1	40.42454	40.42453
8	1	0.05751	0.05751
12	1	24.69815	24.69814
13	1	1.63588	1.63588
14	1	2.03166	2.03166
15	1	1.79152	1.79152
16	1	0.01566	0.01566
17	1	1.84201	1.84201
18	1	0.00858	0.00858
23	1	3.36422	3.36422
24	1	2.69870	2.69870
25	1	8.27954	8.27954
26	1	0.05613	0.05613
27	1	8.51006	8.51006
28	1	0.05775	0.05775
34	1	7.64631	7.64631
35	1	0.39736	0.39736
36	1	0.00777	0.00777
37	1	0.38267	0.38267
38	1	0.00013	0.00013
45	1	0.35105	0.35105
46	1	0.01540	0.01540
47	1	0.35251	0.35251
48	1	0.03330	0.03330
56	1	0.01111	0.01111
57	1	28.80641	28.80641
58	1	0.00011	0.00011
67	1	0.05925	0.05925
68	1	0.01019	0.01019
78	1	0.00007	0.00007
123	1	5.99861	5.99861
124	1	6.39492	6.39492
125	1	0.29016	0.29016
126	1	0.00128	0.00128
127	1	0.30055	0.30055
128	1	0.00883	0.00883
134	1	2.18211	2.18211
135	1	0.00018	0.00018
136	1	0.03577	0.03577
137	1	0.00009	0.00009
138	1	0.02519	0.02519
145	1	0.00853	0.00853
146	1	0.00016	0.00016
147	1	0.00819	0.00819
148	1	0.02225	0.02225
156	1	0.03142	0.03142
157	1	1.10948	1.10948
158	1	0.02517	0.02517
167	1	0.03948	0.03948
168	1	0.00480	0.00480
178	1	0.02521	0.02521
234	1	2.31326	2.31326
235	1	0.48060	0.48060
236	1	0.03741	0.03741
237	1	0.45267	0.45267
238	1	0.00036	0.00036
245	1	0.11884	0.11884
246	1	0.03232	0.03232
247	1	0.11391	0.11391
248	1	0.03349	0.03349

256	1	0.01761	0.01761
257	1	6.67366	6.67365
258	1	0.00068	0.00068
267	1	0.03524	0.03524
268	1	0.01046	0.01046
278	1	0.00064	0.00064
345	1	0.22647	0.22647
346	1	0.00338	0.00338
347	1	0.23050	0.23050
348	1	0.00456	0.00456
356	1	0.01385	0.01385
357	1	0.43128	0.43128
358	1	0.05781	0.05781
367	1	0.00876	0.00876
368	1	0.02228	0.02228
378	1	0.05787	0.05787
456	1	0.00947	0.00947
457	1	0.13359	0.13359
458	1	0.00484	0.00484
467	1	0.00678	0.00678
468	1	0.02510	0.02510
478	1	0.00490	0.00490
567	1	0.02796	0.02796
568	1	0.02271	0.02271
578	1	0.05838	0.05838
678	1	0.02272	0.02272
1234	1	6.16452	6.16452
1235	1	0.16257	0.16257
1236	1	0.03466	0.03466
1237	1	0.17799	0.17799
1238	1	0.02528	0.02528
1245	1	0.25242	0.25242
1246	1	0.00163	0.00163
1247	1	0.25593	0.25593
1248	1	0.02256	0.02256
1256	1	0.03494	0.03494
1257	1	0.20816	0.20816
1258	1	0.02476	0.02476
1267	1	0.02968	0.02968
1268	1	0.00526	0.00526
1278	1	0.02460	0.02460
1345	1	0.00191	0.00191
1346	1	0.05003	0.05003
1347	1	0.00156	0.00156
1348	1	0.01065	0.01065
1356	1	0.00391	0.00391
1357	1	0.00445	0.00445
1358	1	0.00833	0.00833
1367	1	0.00457	0.00457
1368	1	0.03333	0.03333
1378	1	0.00837	0.00837
1456	1	0.06127	0.06127
1457	1	0.00040	0.00040
1458	1	0.01013	0.01013
1467	1	0.05886	0.05886
1468	1	0.00022	0.00022
1478	1	0.01018	0.01018
1567	1	0.00586	0.00586
1568	1	0.03292	0.03292
1578	1	0.00799	0.00799
1678	1	0.03300	0.03300
2345	1	0.20645	0.20645
2346	1	0.01323	0.01323
2347	1	0.20436	0.20436
2348	1	0.00570	0.00570
2356	1	0.00777	0.00777
2357	1	0.10042	0.10042
2358	1	0.05824	0.05824
2367	1	0.01127	0.01127
2368	1	0.02282	0.02282
2378	1	0.05775	0.05775
2456	1	0.00792	0.00792

2457	1	0.15889	0.15889
2458	1	0.00536	0.00536
2467	1	0.00939	0.00939
2468	1	0.02568	0.02568
2478	1	0.00496	0.00496
2567	1	0.01461	0.01461
2568	1	0.02268	0.02268
2578	1	0.05699	0.05699
2678	1	0.02266	0.02266
3456	1	0.02530	0.02530
3457	1	0.22602	0.22602
3458	1	0.03288	0.03288
3467	1	0.02217	0.02217
3468	1	0.00850	0.00850
3478	1	0.03289	0.03289
3567	1	0.02009	0.02009
3568	1	0.00958	0.00958
3578	1	-0.00099	-0.00099
3678	1	0.00954	0.00954
4567	1	0.02219	0.02219
4568	1	0.00786	0.00786
4578	1	0.03226	0.03226
4678	1	0.00780	0.00780
5678	1	0.00865	0.00865
12345	1	0.30715	0.30715
12346	1	0.06861	0.06861
12347	1	0.30521	0.30521
12348	1	0.00876	0.00876
12356	1	0.00474	0.00474
12357	1	0.19681	0.19681
12358	1	0.00829	0.00829
12367	1	0.00519	0.00519
12368	1	0.03246	0.03246
12378	1	0.00853	0.00853
12456	1	0.05376	0.05376
12457	1	0.20296	0.20296
12458	1	0.01010	0.01010
12467	1	0.05770	0.05770
12468	1	-0.00108	-0.00108
12478	1	0.01009	0.01009
12567	1	0.00462	0.00462
12568	1	0.03308	0.03308
12578	1	0.00933	0.00933
12678	1	0.03312	0.03312
13456	1	-0.00028	-0.00028
13457	1	0.00034	0.00034
13458	1	0.02147	0.02147
13467	1	-0.00071	-0.00071
13468	1	0.05617	0.05617
13478	1	0.02145	0.02145
13567	1	0.03225	0.03225
13568	1	0.00422	0.00422
13578	1	0.02500	0.02500
13678	1	0.00412	0.00412
14567	1	0.00022	0.00022
14568	1	0.05725	0.05725
14578	1	0.02201	0.02201
14678	1	0.05707	0.05707
15678	1	0.00496	0.00496
23456	1	0.02349	0.02349
23457	1	0.07966	0.07966
23458	1	0.03199	0.03199
23467	1	0.02481	0.02481
23468	1	0.00686	0.00686
23478	1	0.03213	0.03213
23567	1	0.02159	0.02159
23568	1	0.00953	0.00953
23578	1	-0.00009	-0.00009
23678	1	0.00975	0.00975
24567	1	0.02610	0.02610
24568	1	0.00779	0.00779
24578	1	0.03287	0.03287

24678	1	0.00805	0.00805
25678	1	0.01049	0.01049
34567	1	0.00797	0.00797
34568	1	0.02543	0.02543
34578	1	0.00555	0.00555
34678	1	0.02541	0.02541
35678	1	0.02378	0.02378
45678	1	0.02650	0.02650
123456	1	0.00155	0.00155
123457	1	0.16287	0.16287
123458	1	0.02396	0.02396
123467	1	0.00179	0.00179
123468	1	0.06105	0.06105
123478	1	0.02421	0.02421
123567	1	0.03595	0.03595
123568	1	0.00572	0.00572
123578	1	0.02603	0.02603
123678	1	0.00593	0.00593
124567	1	0.00096	0.00096
124568	1	0.05888	0.05888
124578	1	0.02295	0.02295
124678	1	0.05917	0.05917
125678	1	0.00542	0.00542
134567	1	0.06111	0.06111
134568	1	0.00210	0.00210
134578	1	0.01167	0.01167
134678	1	0.00218	0.00218
135678	1	0.03409	0.03409
145678	1	0.00103	0.00103
234567	1	0.01071	0.01071
234568	1	0.02693	0.02693
234578	1	0.00682	0.00682
234678	1	0.02727	0.02727
235678	1	0.02344	0.02344
245678	1	0.02647	0.02647
345678	1	0.00745	0.00745
1234567	1	0.05547	0.05547
1234568	1	-0.00175	-0.00175
1234578	1	0.00839	0.00839
1234678	1	-0.00224	-0.00224
1235678	1	0.03162	0.03162
1245678	1	-0.00165	-0.00165
1345678	1	0.05442	0.05442
2345678	1	0.00634	0.00634
RESIDUAL	1	0.04004	0.04004
TOTAL	255	512.57520	

RESULTS OF THE FACTORIAL ANALYSIS FOR
AMBUSHER FORCE AT 3.0 MIN.

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES
1	1	61.61262	61.61261
2	1	513.38409	513.38403
3	1	40.36075	40.36075
4	1	17.33491	17.33490
5	1	55.69465	55.69464
6	1	1.08171	1.08171
7	1	49.18243	49.18242
8	1	30.70987	30.70987
12	1	39.43191	39.43190
13	1	0.43694	0.43694
14	1	0.89036	0.89036
15	1	3.63538	3.63538
16	1	0.01063	0.01063
17	1	5.78158	5.78158
18	1	4.84375	4.84375
23	1	7.29207	7.29207
24	1	4.38739	4.38739
25	1	2.76190	2.76190
26	1	0.00604	0.00604
27	1	1.28675	1.28675
28	1	0.01300	0.01300
34	1	21.79911	21.79910
35	1	0.11709	0.11708
36	1	0.05212	0.05212
37	1	0.36039	0.36039
38	1	0.00117	0.00117
45	1	0.33075	0.33075
46	1	0.03053	0.03053
47	1	0.70963	0.70963
48	1	0.30687	0.30687
56	1	0.42088	0.42088
57	1	2.66161	2.66161
58	1	5.91958	5.91958
67	1	0.26171	0.26171
68	1	0.01400	0.01400
78	1	6.49171	6.49170
123	1	7.61068	7.61068
124	1	7.79562	7.79562
125	1	4.24121	4.24121
126	1	0.19181	0.19181
127	1	6.94340	6.94340
128	1	4.85962	4.85962
134	1	0.18655	0.18655
135	1	1.49021	1.49021
136	1	0.04641	0.04641
137	1	2.79776	2.79776
138	1	2.43529	2.43528
145	1	0.10267	0.10267
146	1	0.01235	0.01235
147	1	0.00251	0.00251
148	1	0.66442	0.66442
156	1	0.01654	0.01654
157	1	1.99329	1.99329
158	1	0.57561	0.57561
167	1	0.00668	0.00668
168	1	0.06866	0.06866
178	1	0.84072	0.84072
234	1	3.03336	3.03336
235	1	3.58776	3.58776
236	1	0.00471	0.00471
237	1	2.93601	2.93601
238	1	4.47385	4.47385
245	1	1.50577	1.50577
246	1	0.02035	0.02035
247	1	2.47156	2.47156

248	1	1.11628	1.11628
256	1	0.17787	0.17787
257	1	8.01247	8.01247
258	1	3.24731	3.24731
267	1	0.21408	0.21408
268	1	0.68233	0.68233
278	1	3.11483	3.11483
345	1	0.04757	0.04757
346	1	0.01211	0.01211
347	1	0.09593	0.09593
348	1	0.00068	0.00068
356	1	0.02584	0.02584
357	1	0.36268	0.36268
358	1	0.00610	0.00610
367	1	0.08918	0.08918
368	1	0.00601	0.00601
378	1	0.03763	0.03763
456	1	0.06604	0.06604
457	1	0.01467	0.01467
458	1	0.25250	0.25250
467	1	0.01956	0.01956
468	1	0.29868	0.29868
478	1	0.35245	0.35245
567	1	0.09667	0.09667
568	1	0.73222	0.73222
578	1	0.17530	0.17530
678	1	0.11694	0.11694
1234	1	9.85504	9.85504
1235	1	0.61117	0.61117
1236	1	0.01260	0.01260
1237	1	0.16633	0.16633
1238	1	0.08627	0.08627
1245	1	0.01281	0.01281
1246	1	0.13537	0.13537
1247	1	0.21159	0.21159
1248	1	0.28481	0.28481
1256	1	0.17182	0.17182
1257	1	0.05101	0.05101
1258	1	0.42939	0.42939
1267	1	0.01280	0.01280
1268	1	0.17971	0.17971
1278	1	0.17608	0.17608
1345	1	0.46250	0.46250
1346	1	0.15569	0.15569
1347	1	1.45046	1.45046
1348	1	1.79210	1.79210
1356	1	0.00372	0.00372
1357	1	0.57585	0.57585
1358	1	0.01854	0.01854
1367	1	0.00243	0.00243
1368	1	0.10188	0.10188
1378	1	0.04781	0.04781
1456	1	0.03182	0.03182
1457	1	0.53511	0.53511
1458	1	0.15089	0.15089
1467	1	0.03866	0.03866
1468	1	0.40167	0.40167
1478	1	0.10707	0.10707
1567	1	0.04290	0.04290
1568	1	0.14594	0.14594
1578	1	0.17270	0.17270
1678	1	-0.00004	-0.00004
2345	1	2.98784	2.98784
2346	1	0.18834	0.18834
2347	1	1.63359	1.63359
2348	1	1.94131	1.94131
2356	1	0.00268	0.00268
2357	1	2.24660	2.24660
2358	1	0.34781	0.34781
2367	1	0.00023	0.00023
2368	1	0.16947	0.16947
2378	1	0.30494	0.30494
2456	1	0.01086	0.01086

2457	1	0.65301	0.65301
2458	1	0.16991	0.16991
2467	1	0.10129	0.10129
2468	1	0.00378	0.00378
2478	1	0.05940	0.05940
2567	1	0.38090	0.38090
2568	1	0.00191	0.00191
2578	1	10.98462	10.98462
2678	1	0.21266	0.21266
3456	1	0.10166	0.10166
3457	1	0.03032	0.03032
3458	1	0.02962	0.02962
3467	1	0.05394	0.05394
3468	1	0.36439	0.36439
3478	1	0.02435	0.02435
3567	1	0.10855	0.10855
3568	1	0.28919	0.28919
3578	1	0.31938	0.31938
3678	1	0.00813	0.00813
4567	1	0.01672	0.01672
4568	1	0.00403	0.00403
4578	1	0.33251	0.33251
4678	1	0.15902	0.15902
5678	1	0.19772	0.19772
12345	1	0.37168	0.37168
12346	1	0.04188	0.04188
12347	1	0.02609	0.02609
12348	1	0.03806	0.03806
12356	1	0.04518	0.04518
12357	1	0.00889	0.00889
12358	1	0.09073	0.09073
12367	1	0.03797	0.03797
12368	1	0.35178	0.35178
12378	1	0.08690	0.08690
12456	1	0.01554	0.01554
12457	1	2.68781	2.68781
12458	1	0.55805	0.55805
12467	1	0.04142	0.04142
12468	1	0.04130	0.04130
12478	1	0.53369	0.53369
12567	1	0.00455	0.00455
12568	1	0.07004	0.07004
12578	1	10.03398	10.03398
12678	1	-0.00004	-0.00004
13456	1	0.15535	0.15535
13457	1	0.19233	0.19233
13458	1	0.00153	0.00153
13467	1	0.02894	0.02894
13468	1	0.26531	0.26531
13478	1	0.01093	0.01093
13567	1	0.00764	0.00764
13568	1	0.29835	0.29835
13578	1	1.44256	1.44256
13678	1	0.08232	0.08232
14567	1	0.18743	0.18743
14568	1	0.02355	0.02355
14578	1	3.29275	3.29275
14678	1	0.07355	0.07355
15678	1	-0.00112	-0.00112
23456	1	0.03162	0.03162
23457	1	0.11719	0.11719
23458	1	0.01175	0.01175
23467	1	0.02840	0.02840
23468	1	0.05215	0.05215
23478	1	0.02929	0.02929
23567	1	0.00067	0.00067
23568	1	0.02463	0.02463
23578	1	1.52421	1.52421
23678	1	0.15086	0.15086
24567	1	0.13995	0.13995
24568	1	0.35359	0.35359
24578	1	2.81548	2.81548

24678	1	0.05256	0.05256
25678	1	0.09725	0.09725
34567	1	0.12728	0.12728
34568	1	0.05116	0.05116
34578	1	0.02261	0.02261
34678	1	0.00979	0.00979
35678	1	0.00138	0.00138
45678	1	0.18860	0.18860
123456	1	0.02565	0.02565
123457	1	0.23488	0.23488
123458	1	0.05018	0.05018
123467	1	0.08209	0.08209
123468	1	0.00948	0.00948
123478	1	0.09939	0.09939
123567	1	0.14371	0.14371
123568	1	0.05152	0.05152
123578	1	0.08685	0.08685
123678	1	0.01707	0.01707
124567	1	-0.00110	-0.00110
124568	1	0.39951	0.39951
124578	1	0.43502	0.43502
124678	1	0.08936	0.08936
125678	1	0.00124	0.00124
134567	1	0.00784	0.00784
134568	1	0.02075	0.02075
134578	1	1.96143	1.96143
134678	1	0.05518	0.05518
135678	1	0.26676	0.26676
145678	1	0.02205	0.02205
234567	1	-0.00019	-0.00019
234568	1	0.30958	0.30958
234578	1	1.54018	1.54018
234678	1	0.01692	0.01692
235678	1	0.22296	0.22296
245678	1	0.05598	0.05598
345678	1	0.00884	0.00884
1234567	1	0.12761	0.12761
1234568	1	0.26836	0.26836
1234578	1	0.04563	0.04563
1234678	1	0.00313	0.00313
1235678	1	0.00120	0.00120
1245678	1	0.23113	0.23113
1345678	1	0.04365	0.04365
2345678	1	0.07210	0.07210
RESIDUAL	1	-0.01831	-0.01831
TOTAL	255	1036.91431	

APPENDIX M: NUMERICAL RESULTS OF THE FACTORIAL ANALYSIS FOR AMBUSHEE FORCE AT 3.0 MIN.

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES
1	1	1270.61719	1270.61719
2	1	6019.58691	6019.58594
3	1	242.36725	242.36725
4	1	193.40152	193.40152
5	1	29.82811	29.82811
6	1	0.41639	0.41639
7	1	29.73141	29.73140
8	1	2.84860	2.84860
12	1	826.51266	826.51245
13	1	71.69913	71.69913
14	1	74.32917	74.32916
15	1	0.09515	0.09515
16	1	0.03235	0.03235
17	1	0.09314	0.09314
18	1	0.03656	0.03656
23	1	78.50647	78.50647
24	1	57.97504	57.97504
25	1	0.07520	0.07520
26	1	0.12598	0.12598
27	1	0.08496	0.08496
28	1	0.98828	0.98828
34	1	192.31811	192.31810
35	1	2.16051	2.16051
36	1	0.02279	0.02279
37	1	2.15414	2.15414
38	1	0.11634	0.11634
45	1	0.26595	0.26595
46	1	0.00478	0.00478
47	1	0.28303	0.28303
48	1	0.05255	0.05255
56	1	0.08687	0.08687
57	1	21.49348	21.49347
58	1	2.09487	2.09486
67	1	0.18376	0.18376
68	1	0.07353	0.07353
78	1	2.16512	2.16512
123	1	167.91260	167.91260
124	1	165.23975	165.23975
125	1	4.41821	4.41821
126	1	-0.01874	-0.01874
127	1	4.25676	4.25676
128	1	0.32766	0.32766
134	1	74.72204	74.72203
135	1	0.02699	0.02699
136	1	-0.02579	-0.02579
137	1	0.02890	0.02890
138	1	-0.02206	-0.02206
145	1	0.19167	0.19167
146	1	-0.02462	-0.02462
147	1	0.16514	0.16514
148	1	-0.01746	-0.01746
156	1	-0.02129	-0.02129
157	1	-0.02187	-0.02187
158	1	-0.01981	-0.01981
167	1	-0.02293	-0.02293
168	1	-0.02319	-0.02319
178	1	-0.01884	-0.01884
234	1	57.90283	57.90283
235	1	2.18115	2.18115
236	1	-0.01477	-0.01477
237	1	2.14966	2.14966
238	1	-0.01404	-0.01404
245	1	0.49780	0.49780
246	1	-0.02393	-0.02393
247	1	0.45020	0.45020

248	1	-0.02014	-0.02014
256	1	0.02856	0.02856
257	1	0.02869	0.02869
258	1	0.72083	0.72083
267	1	0.03540	0.03540
268	1	0.02002	0.02002
278	1	0.74878	0.74878
345	1	0.27708	0.27708
346	1	0.00700	0.00700
347	1	0.27011	0.27011
348	1	0.05105	0.05105
356	1	0.00974	0.00974
357	1	1.89772	1.89772
358	1	0.09008	0.09008
367	1	0.01601	0.01601
368	1	0.00378	0.00378
378	1	0.08794	0.08794
456	1	0.00195	0.00195
457	1	0.19577	0.19577
458	1	0.03533	0.03533
467	1	0.00216	0.00216
468	1	0.00082	0.00082
478	1	0.04194	0.04194
567	1	0.13537	0.13537
568	1	0.04127	0.04127
578	1	1.80065	1.80065
678	1	0.06691	0.06691
1234	1	164.98401	164.98401
1235	1	0.04539	0.04539
1236	1	0.03209	0.03209
1237	1	0.04921	0.04921
1238	1	0.16602	0.16602
1245	1	0.53973	0.53973
1246	1	0.03673	0.03673
1247	1	0.56723	0.56723
1248	1	0.10687	0.10687
1256	1	0.01137	0.01137
1257	1	2.16971	2.16971
1258	1	0.28816	0.28816
1267	1	0.01987	0.01987
1268	1	0.02618	0.02618
1278	1	0.28720	0.28720
1345	1	0.23979	0.23979
1346	1	0.02322	0.02322
1347	1	0.23453	0.23453
1348	1	0.02670	0.02670
1356	1	0.02477	0.02477
1357	1	0.18959	0.18959
1358	1	0.02203	0.02203
1367	1	0.02399	0.02399
1368	1	0.02036	0.02036
1378	1	0.02150	0.02150
1456	1	0.02344	0.02344
1457	1	0.09440	0.09440
1458	1	0.02435	0.02435
1467	1	0.02108	0.02108
1468	1	0.02027	0.02027
1478	1	0.02743	0.02743
1567	1	0.01955	0.01955
1568	1	0.01801	0.01801
1578	1	0.01923	0.01923
1678	1	0.01767	0.01767
2345	1	0.43840	0.43840
2346	1	-0.02161	-0.02161
2347	1	0.42783	0.42783
2348	1	-0.02835	-0.02835
2356	1	-0.03938	-0.03938
2357	1	1.51643	1.51643
2358	1	-0.04251	-0.04251
2367	1	-0.03772	-0.03772
2368	1	-0.02670	-0.02670
2378	1	-0.03517	-0.03517
2456	1	-0.02780	-0.02780

2457	1	0.18283	0.18283
2458	1	-0.03506	-0.03506
2467	1	-0.02655	-0.02655
2468	1	-0.02121	-0.02121
2478	1	-0.02640	-0.02640
2567	1	-0.00740	-0.00740
2568	1	-0.01294	-0.01294
2578	1	0.59651	0.59651
2678	1	0.00586	0.00586
3456	1	0.00403	0.00403
3457	1	0.19789	0.19789
3458	1	0.04191	0.04191
3467	1	0.00652	0.00652
3468	1	0.00435	0.00435
3478	1	0.03962	0.03962
3567	1	0.01328	0.01328
3568	1	0.00363	0.00363
3578	1	0.08685	0.08685
3678	1	0.00545	0.00545
4567	1	0.00458	0.00458
4568	1	0.00221	0.00221
4578	1	0.03286	0.03286
4678	1	0.00185	0.00185
5678	1	0.03579	0.03579
12345	1	0.62612	0.62612
12346	1	0.04174	0.04174
12347	1	0.60480	0.60480
12348	1	0.10793	0.10793
12356	1	0.05639	0.05639
12357	1	0.06137	0.06137
12358	1	0.15637	0.15637
12367	1	0.04677	0.04677
12368	1	0.04057	0.04057
12378	1	0.14629	0.14629
12456	1	0.04813	0.04813
12457	1	0.42266	0.42266
12458	1	0.09153	0.09153
12467	1	0.03961	0.03961
12468	1	0.03098	0.03098
12478	1	0.09110	0.09110
12567	1	0.05966	0.05966
12568	1	0.05835	0.05835
12578	1	0.29171	0.29171
12678	1	0.04750	0.04750
13456	1	-0.01488	-0.01488
13457	1	0.06792	0.06792
13458	1	-0.00966	-0.00966
13467	1	-0.01520	-0.01520
13468	1	-0.01670	-0.01670
13478	1	-0.01116	-0.01116
13567	1	-0.01239	-0.01239
13568	1	-0.01399	-0.01399
13578	1	-0.00937	-0.00937
13678	1	-0.01345	-0.01345
14567	1	-0.01302	-0.01302
14568	1	-0.01329	-0.01329
14578	1	-0.00869	-0.00869
14678	1	-0.01379	-0.01379
15678	1	-0.01154	-0.01154
23456	1	0.09946	0.09946
23457	1	0.32606	0.32606
23458	1	0.09915	0.09915
23467	1	0.09491	0.09491
23468	1	0.08621	0.08621
23478	1	0.09680	0.09680
23567	1	0.11080	0.11080
23568	1	0.10773	0.10773
23578	1	0.11360	0.11360
23678	1	0.10333	0.10333
24567	1	0.10330	0.10330
24568	1	0.09869	0.09869
24578	1	0.10425	0.10425

24678	1	0.09149	0.09149
25678	1	0.12610	0.12610
34567	1	0.00033	0.00033
34568	1	-0.00013	-0.00013
34578	1	0.03737	0.03737
34678	1	0.00186	0.00186
35678	1	0.00105	0.00105
45678	1	0.00226	0.00226
123456	1	-0.09651	-0.09651
123457	1	0.29734	0.29734
123458	1	-0.03487	-0.03487
123467	1	-0.08009	-0.08009
123468	1	-0.07354	-0.07354
123478	1	-0.03187	-0.03187
123567	1	-0.10500	-0.10500
123568	1	-0.10275	-0.10275
123578	1	-0.01129	-0.01129
123678	1	-0.09007	-0.09007
124567	1	-0.10191	-0.10191
124568	1	-0.09108	-0.09108
124578	1	-0.05274	-0.05274
124678	1	-0.08318	-0.08318
125678	1	-0.10976	-0.10976
134567	1	0.01369	0.01369
134568	1	0.01367	0.01367
134578	1	0.01891	0.01891
134678	1	0.01429	0.01429
135678	1	0.01038	0.01038
145678	1	0.00945	0.00945
234567	1	-0.15896	-0.15896
234568	1	-0.14786	-0.14786
234578	1	-0.15279	-0.15279
234678	1	-0.14507	-0.14507
235678	1	-0.17028	-0.17028
245678	1	-0.15945	-0.15945
345678	1	0.00057	0.00057
1234567	1	0.15374	0.15374
1234568	1	0.14192	0.14192
1234578	1	0.19723	0.19723
1234678	1	0.13976	0.13976
1235678	1	0.17240	0.17240
1245678	1	0.16136	0.16136
1345678	1	-0.01415	-0.01415
2345678	1	0.22730	0.22730
RESIDUAL	1	-0.57813	-0.57813
TOTAL	255	9786.60938	

APPENDIX N: NUMERICAL RESULTS OF THE FACTORIAL ANALYSIS FOR AMBUSHEE-AMBUSHER FORCE RATIO AT 3.0 MIN.

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES
1	1	183.57733	183.57733
2	1	1492.46045	1492.46045
3	1	59.03209	59.03207
4	1	32.89869	32.89868
5	1	57.51676	57.51675
6	1	0.00704	0.00704
7	1	50.12973	50.12973
8	1	33.31294	33.31293
12	1	67.55560	67.55560
13	1	2.26662	2.26662
14	1	0.92300	0.92300
15	1	8.49704	8.49704
16	1	0.03283	0.03283
17	1	5.65813	5.65813
18	1	3.66135	3.66135
23	1	0.84528	0.84528
24	1	1.43878	1.43878
25	1	0.92291	0.92291
26	1	0.43744	0.43744
27	1	0.25677	0.25677
28	1	1.65796	1.65796
34	1	43.76300	43.76300
35	1	0.00198	0.00198
36	1	0.36154	0.36154
37	1	0.02568	0.02568
38	1	0.06692	0.06692
45	1	0.95323	0.95323
46	1	0.01624	0.01624
47	1	0.42910	0.42910
48	1	0.11085	0.11085
56	1	0.04849	0.04849
57	1	3.41471	3.41471
58	1	7.23941	7.23941
67	1	0.01276	0.01276
68	1	0.01558	0.01558
78	1	10.07667	10.07667
123	1	41.88952	41.88951
124	1	35.20464	35.20464
125	1	9.33140	9.33140
126	1	0.70011	0.70011
127	1	12.61855	12.61855
128	1	6.48897	6.48897
134	1	3.74399	3.74399
135	1	2.78161	2.78161
136	1	0.26867	0.26867
137	1	2.25478	2.25478
138	1	2.05682	2.05682
145	1	3.56601	3.56601
146	1	0.89662	0.89662
147	1	2.58633	2.58633
148	1	1.00979	1.00978
156	1	0.13358	0.13358
157	1	0.05665	0.05665
158	1	0.30470	0.30470
167	1	0.00225	0.00225
168	1	0.04457	0.04457
178	1	1.01486	1.01486
234	1	0.06746	0.06746
235	1	5.38811	5.38811
236	1	0.05522	0.05522
237	1	7.08044	7.08044
238	1	5.55099	5.55099
245	1	1.32123	1.32123
246	1	0.40899	0.40899
247	1	1.92135	1.92135
248	1	0.72395	0.72395

256	1	0.14470	0.14470
257	1	9.67756	9.67756
258	1	7.01736	7.01736
267	1	0.00789	0.00789
268	1	0.06018	0.06018
278	1	8.68439	8.68439
345	1	0.00594	0.00594
346	1	0.54252	0.54252
347	1	0.26255	0.26255
348	1	0.03537	0.03537
356	1	0.17534	0.17534
357	1	0.14629	0.14629
358	1	0.18758	0.18758
367	1	0.01311	0.01311
368	1	0.02301	0.02301
378	1	0.01622	0.01622
456	1	0.11454	0.11454
457	1	0.12044	0.12044
458	1	0.29358	0.29358
467	1	0.01641	0.01641
468	1	0.06651	0.06651
478	1	0.88656	0.88656
567	1	0.00845	0.00845
568	1	0.00272	0.00272
578	1	0.01464	0.01464
678	1	0.11076	0.11076
1234	1	24.59115	24.59114
1235	1	0.03008	0.03008
1236	1	0.05478	0.05478
1237	1	0.17471	0.17471
1238	1	0.49588	0.49588
1245	1	0.06827	0.06827
1246	1	0.21931	0.21931
1247	1	0.18943	0.18943
1248	1	0.04927	0.04927
1256	1	0.39564	0.39564
1257	1	0.72672	0.72672
1258	1	0.25698	0.25698
1267	1	0.02274	0.02274
1268	1	0.05260	0.05260
1278	1	0.59144	0.59144
1345	1	0.84791	0.84791
1346	1	0.05720	0.05720
1347	1	1.94897	1.94897
1348	1	0.61814	0.61814
1356	1	0.12062	0.12062
1357	1	0.00892	0.00892
1358	1	0.15563	0.15563
1367	1	0.00977	0.00977
1368	1	0.02285	0.02285
1378	1	0.00070	0.00070
1456	1	0.55471	0.55471
1457	1	0.42723	0.42723
1458	1	0.15610	0.15610
1467	1	0.80766	0.80766
1468	1	0.59196	0.59196
1478	1	0.00422	0.00422
1567	1	0.03525	0.03525
1568	1	0.00172	0.00172
1578	1	0.14688	0.14688
1678	1	0.15123	0.15123
2345	1	4.24147	4.24147
2346	1	0.06543	0.06543
2347	1	2.36430	2.36430
2348	1	1.03690	1.03690
2356	1	0.20667	0.20667
2357	1	0.16539	0.16539
2358	1	0.31604	0.31604
2367	1	0.05089	0.05089
2368	1	0.12140	0.12140
2378	1	0.05013	0.05013
2456	1	0.20363	0.20363

2457	1	0.98257	0.98257
2458	1	0.35573	0.35573
2467	1	0.02667	0.02667
2468	1	0.05458	0.05458
2478	1	0.74390	0.74390
2567	1	0.13609	0.13609
2568	1	0.02977	0.02977
2578	1	18.48357	18.48357
2678	1	0.12526	0.12526
3456	1	0.29104	0.29104
3457	1	0.03842	0.03842
3458	1	0.14786	0.14786
3467	1	-0.00001	-0.00001
3468	1	0.01778	0.01778
3478	1	0.00371	0.00371
3567	1	0.00706	0.00706
3568	1	0.00332	0.00332
3578	1	0.10375	0.10375
3678	1	0.21743	0.21743
4567	1	0.09568	0.09568
4568	1	0.00319	0.00319
4578	1	1.37948	1.37948
4678	1	0.12471	0.12471
5678	1	0.03274	0.03274
12345	1	1.39159	1.39159
12346	1	0.52274	0.52274
12347	1	0.37076	0.37076
12348	1	0.12542	0.12542
12356	1	0.11158	0.11158
12357	1	0.47191	0.47191
12358	1	0.21007	0.21007
12367	1	0.00382	0.00382
12368	1	0.06177	0.06177
12378	1	-0.02026	-0.02026
12456	1	0.37559	0.37559
12457	1	-0.01858	-0.01858
12458	1	0.12508	0.12508
12467	1	0.84273	0.84273
12468	1	1.37678	1.37678
12478	1	-0.01896	-0.01896
12567	1	0.06906	0.06906
12568	1	-0.02233	-0.02233
12578	1	14.57180	14.57180
12678	1	0.10101	0.10101
13456	1	0.19868	0.19868
13457	1	0.74540	0.74540
13458	1	0.36726	0.36726
13467	1	1.08885	1.08885
13468	1	1.37676	1.37676
13478	1	0.82212	0.82212
13567	1	0.00510	0.00510
13568	1	0.00057	0.00057
13578	1	3.36354	3.36354
13678	1	0.26586	0.26586
14567	1	0.46300	0.46300
14568	1	0.87853	0.87853
14578	1	1.84622	1.84622
14678	1	0.33072	0.33072
15678	1	0.03333	0.03333
23456	1	0.18239	0.18239
23457	1	0.65901	0.65901
23458	1	0.15411	0.15411
23467	1	-0.01820	-0.01820
23468	1	0.07063	0.07063
23478	1	-0.02083	-0.02083
23567	1	0.09977	0.09977
23568	1	-0.01295	-0.01295
23578	1	2.77465	2.77465
23678	1	0.11228	0.11228
24567	1	-0.00722	-0.00722
24568	1	-0.02236	-0.02236
24578	1	5.10949	5.10949

24678	1	0.13553	0.13553
25678	1	0.22346	0.22346
34567	1	0.02927	0.02927
34568	1	0.00627	0.00627
34578	1	0.08034	0.08034
34678	1	0.26269	0.26269
35678	1	0.42023	0.42023
45678	1	0.02942	0.02942
123456	1	0.33848	0.33848
123457	1	0.08657	0.08657
123458	1	0.37660	0.37660
123467	1	1.05002	1.05002
123468	1	0.60096	0.60096
123478	1	1.06825	1.06825
123567	1	0.14328	0.14328
123568	1	0.03662	0.03662
123578	1	0.04256	0.04256
123678	1	0.22006	0.22006
124567	1	1.31574	1.31574
124568	1	1.02348	1.02348
124578	1	0.08159	0.08159
124678	1	0.33167	0.33167
125678	1	0.29952	0.29952
134567	1	1.60887	1.60887
134568	1	1.02510	1.02510
134578	1	5.39138	5.39138
134678	1	0.37098	0.37098
135678	1	0.53699	0.53699
145678	1	0.58859	0.58859
234567	1	0.08719	0.08719
234568	1	0.03600	0.03600
234578	1	1.89877	1.89877
234678	1	0.24195	0.24195
235678	1	0.05400	0.05400
245678	1	0.34584	0.34584
345678	1	0.50096	0.50096
1234567	1	0.63330	0.63330
1234568	1	0.87630	0.87630
1234578	1	1.43614	1.43614
1234678	1	0.36809	0.36809
1235678	1	0.02500	0.02500
1245678	1	0.09474	0.09474
1345678	1	0.17887	0.17887
2345678	1	0.06908	0.06908
RESIDUAL	1	0.71973	0.71973
TOTAL	255	2381.32544	

LIST OF REFERENCES

1. Bonder, Seth. "The Lanchester Attrition-Rate Coefficient," Operations Research, March-April 1967.

2. Burnell, R. W. Parameter Estimates for Mathematical Models of Convoy Ambushes, M.Sc. Thesis, NPGS, June 1968.

3. Deitchman, S. J. "A Lanchester Model of Guerrilla Warfare," Operations Research, November-December 1962.

4. Lanchester, Frederick W. "Mathematics in Warfare," The World of Mathematics, Vol. IV, (James R. Newman, Ed.) Simon and Schuster, 1956.

5. Riddhiroj, S. A Lanchester-Based Model for Investigating Alternative Ambusher Deployment Tactics in Small Unit Ambushes, M.Sc. Thesis, NPGS, June 1974.

6. Schaffer, Marvin B. "Lanchester Models of Guerrilla Engagements," Operations Research, May-June 1968.

7. Schudde, Rex. "Lanchester Theory of Combat," Chapter 6 in Selected Methods and Models in Military Operations Research, ONR, 1971.

Weiss, Herbert K. "Lanchester Models," Proceedings, 14th Military Operations Research Symposium, October 1963.

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